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ABSTRACT

These 19 papers from the second annual Policy Forum on Employability Development explore the responsiveness of various educational and training institutions to changing labor market demands. The first three papers provide an overview of the forum. They summarize the proceedings and policy considerations and address how vocational education and training can be responsive to change. The next four papers focus on occupational projections. Specific topics are accuracy and utilization of occupational forecasts, labor market models for college-trained workers, and reactor comments on occupational forecasting and projections. The third section on early warning systems contains four papers that address preparation of staffing requirements data at the micro- or plant level, a descriptive survey of the employment effects of the defense budget, and reactor comments on these two presentations. Seven papers deal with state and local adjustments to changing labor market demands, specifically the states' human resource development role, local coordination and linking efforts among employment and training programs, vocational education's response to skilled industrial worker shortages, factors influencing vocational education program decisions, and two papers with reactor comments. A paper on the experiences of other countries in responding to changes in the demand for skilled workers and reactor comments conclude the volume. (YLB)

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RESPONSIVENESS OF TRAINING INSTITUTIONS TO CHANGING LABOR MARKET DEMANDS

Robert E. Taylor
Howard Rosen
Frank C. Pratzner
Editors

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The National Center for Research in Vocational Education
The Ohio State University
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1983

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U.S. Department of Education
National Institute of Education

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Preface

What kind of information is needed by education and training institutions, as well as by policymakers, that will enable them to adjust to new demands for skilled workers? What coordination among the different training systems in the United States and the world of work facilitates the movement of individuals from training to employment?

These two questions were the primary and subsidiary focuses of the second annual Policy Forum on Employability Development. Held in September 1982 by the National Center for Research in Vocational Education in Washington, DC, the Forum was sponsored by the National Institute of Education.

The first Policy Forum, given by the National Center in October 1981 was a comprehensive examination of the contributions of various training institutions in the United States that prepare workers for the world of work. The resulting papers from that Forum were published in the volume, *Job Training for Youth.*

In this new volume, the papers from the second Policy Forum have been compiled, resulting in an exploration of the responsiveness of various education and training institutions to changing labor market demands. This information will be of interest to policymakers and researchers who participate in the making of more informed decisions about the training of a skilled labor force.

The National Center has engaged in organizing the Forums and producing the resulting papers in order to bring to the attention of policymakers problems and issues affecting training programs. This publication contributes to the continuation of thoughtful dialogue and debate concerning the need for adjusting our training institutions to changes in the demand for workers. We hope to continue in our contributions to that dialogue through this and subsequent annual Policy Forums and resulting publications.

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As editors, we have taken minor liberties in preparing the materials for this volume. In particular, in chapter 2 we have attempted to summarize our sense of the policy considerations and recommendations growing out of the Forum. We take full responsibility for these interpretations and conclusions.

A great many people contributed to the second annual Policy Forum and to preparation of this volume. We wish especially to express our appreciation to the National Institute of Education for its support of the research program on employability development of which this Forum is a part. We wish to thank Beatrice Reubens, Charles Knapp, and Kevin Hollenbeck for their review and comments on early drafts of chapters 1 and 2. We also wish to thank Janet Kiplinger and her staff for editorial assistance, and Vera Mueller for her help in conducting the Forum and preparing the final manuscript.

Columbus, Ohio
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Robert E. Taylor
Howard Rosen
Frank C. Pratzner

Contributors

Howard Rosen is a Consultant to the National Center for Research in Vocational Education and former Director, Office of Research and Development, Employment and Training Administration, U.S. Department of Labor, Washington, DC.

Robert E. Taylor is Executive Director, the National Center for Research in Vocational Education, The Ohio State University, Columbus, Ohio.

Frank C. Pratzner is Senior Research Specialist, the National Center for Research in Vocational Education, The Ohio State University, Columbus, Ohio.

Paul E. Barton is Executive Vice-President, National Institute for Work and Learning, Washington, DC.

Harold Goldstein is an Economic Consultant and former Assistant Commissioner, Bureau of Labor Statistics, U.S. Department of Labor, Washington, DC.

Herrington J. Bryce is President, National Policy Institute, Washington, DC.

Richard B. Freeman is Professor of Economics, Harvard University, Cambridge, Massachusetts.

John A. Hansen is Professor of Economics, Center for Policy Alternatives, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Sar A. Levitan is Director, Center for Social Policy Studies, The George Washington University, Washington, DC.

9

Marc A. Matland is an Economic Consultant formerly with the Employment and Training Administration, U.S. Department of Labor, Washington, DC.

Pat Choate is Senior Policy Analyst, TRW, Washington, DC.

Charles Dale is an Economist, Personnel Policy Research Group, U.S. Army Research Institute, Alexandria, Virginia.

Richard V.L. Cooper is Director, Economic Studies Group, Coopers and Lybrand, Washington, DC.

David W. Stevens is Professor of Economics, University of Missouri, Columbia, Missouri.

V. Lane Rawlins is Assistant Provost, Washington State University, Pullman, Washington.

Jack A. Meyer is a Resident Fellow, American Enterprise Institute, Washington, DC.

Harold Starr is Senior Research Specialist, the National Center for Research in Vocational Education, The Ohio State University, Columbus, Ohio.

Stephen J. Franchak is Research Specialist, the National Center for Research in Vocational Education, The Ohio State University, Columbus, Ohio

Ronald E. Kutscher is Assistant Commissioner, Bureau of Labor Statistics, U.S. Department of Labor, Washington, DC.

Beatrice G. Reubens is Senior Research Associate, Conservation of Human Resources, Columbia University, New York, New York.

C. Michael Aho is Deputy Director, Office of International Economic Affairs, U.S. Department of Labor, Washington, DC.

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STEPHEN E. BALDWIN
Senior Staff Economist
National Commission for
Employment Policy
Washington, DC

RICHARD DiEUGENIO
Senior Legislative Associate
Minority Staff
Committee on Education and Labor
U.S. House of Representatives
Washington, DC

RUPERT N. EVANS
Professor of Vocational Education
University of Illinois
Champaign-Urbana, Illinois

CHARLES B. KNAPP
Senior Vice-President for
Operations
Tulane University
New Orleans, Louisiana

MALCOLM LOVELL
Undersecretary of Labor
U.S. Department of Labor
Washington, DC

MARION PINES
Director, Mayor's Office of
Manpower Resources
Baltimore, Maryland

Overview

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ROBERT E. TAYLOR, HOWARD ROSEN,
FRANK C. PRATZNER

Introduction: Responsiveness of Training Institutions to Changing Labor Market Demands

In a dynamic economy such as that of the United States, changes constantly occur in the nature of work and in the skill content of jobs. These job changes originate from a variety of sources. For example, shifts in consumer demand have increased employment in the service sector of the economy and have increased the need for white-collar workers. Demographic developments, such as the decline in young entrants to the labor force, the expected rise in the number of older workers remaining in the labor force, and the increased labor force participation of women, have affected jobs and the nature of work in America. International competition has reduced employment in some industries such as in automobile and steel production, and stimulated employment growth in other industries, particularly in the services and high technology sectors. National defense policies have also changed the demand for certain professional, technial, and skilled workers.

All of these kinds of changes in the labor market have implications for skill training and how that training is provided. This was the focus of the second annual Policy Forum. In particular, this Forum centered on the responsiveness of our education and training institutions to actual and anticipated changes in labor market demand.

The first Forum highlighted the diversity of this country's job training institutions. It pointed out that this enormous variety among training institutions and programs ensured that they would respond in different ways to changing labor market demands.

Because training institutions are different and are generally locally oriented, there is considerable need for coordination in the collection and use of labor market data, and in training and placement of graduates of training institutions. In order to be responsive to changes in the need for workers, education and training institutions must also have timely and accurate information that alerts them to labor market developments.

Educators and training directors need forecasts of changing labor market demands so that they can adjust their course offerings and make their training relevant to actual and anticipated employment opportunities and requirements. Parents, students, and vocational guidance counselors also have need of forecasts for making career decisions and providing advice about career choices.

Accurate information is needed about both short- and long-term labor market developments. Information about short-term training needs can be secured from advisory committees, local employer surveys, or public labor market intermediaries, such as the U.S. Employment Service.

However, these sources of information are often inadequate for providing data about long-term employment trends. Long-term occupational and industrial forecasting requires a comprehensive view of the economy, specialized knowledge about basic shifts in the demand for workers, and access to a great variety of economic and social data. The federal government and some state governments have provided leadership in long-term occupational forecasting. Although the federal establishment plays a relatively minor and indirect role in the training of our labor force, it plays a major role in developing national occupational information and providing the analysis required for long-term forecasting.

HIGHLIGHTS OF THE FORUM

The proceedings of the second Policy Forum can be summarized best in relation to the three broad themes of occupational forecasting, institutional responsiveness, and program coordination.

Occupational Forecasting

National occupational forecasts are useful to vocational educators if, in using them, educators work with knowledgeable local analysts who can interpret them in relation to local economies. Despite limitations, occupational forecasting can contribute to more efficient operation of the labor market, and can enable students, parents, and educators to make wiser investment decisions for careers and training. Forecasts are primarily needed for professional, technical, craft, and other occupations requiring long periods of specific training. These amount to about one out of three jobs in the United States.

While occupational forecasting models can be useful to individuals and institutions alike in planning education and training for work, they can be costly and subject to a variety of errors. The most fundamental problem of occupational forecasting has less to do with its quality than with the mechanisms for translating forecasts into training programs and effective policy.

Forecasting is a difficult undertaking that is apparently a combination of art and science. For the most part, forecasters have done only moderately well in identifying most occupations in which employment has declined. They have done better in determining those occupations that have had very rapid growth. Forecasts with behavioral labor market models are an improvement over crude trend analyses. However, further explanation and improvement of behavioral models are still needed to increase their accuracy.

The validity of national forecasting models is vulnerable to unanticipated economic and social changes, time lags, and shifting political and policy decisions. For example, occupational projections are often based on excessively optimistic assumptions about the economy. Moreover, the inability of forecasters to anticipate adequately the employment effects of technological change has been a frequent contributing source of error in forecasts. Even the most sophisticated models have been of limited assistance in planning adjustments to the effects of international trade, technological changes, such as the introduction of computers and robotics, and the development of high technology industries.

The accuracy of local occupational forecasts is also questionable. Often they fail to capture or take into account such developments as plant closings, openings, and expansions. Moreover, most local forecasts make assumptions about the availability or the supply of workers that may not be warranted. For example, it has been reported that between 67 and 78 percent of young people between the ages of twenty-two and twenty-nine change their residences in a five-year period. The high mobility rate of these young workers suggests that a sizeable proportion of them will not remain in or be employed in the geographic area in which they obtain their training. Their mobility can significantly affect local estimates of the supply of workers both in the areas they leave and in the areas to which they move.

Nevertheless, a system for forecasting occupational demand at the local level can be useful for planning educational programs at vocational institutions. A model of an early warning system has been developed for the U.S. Department of Labor to forecast labor requirements for specified government construction or manufacturing procurement awards. This model shows potential for planning local training programs. The most striking aspect of this model is that, with the aid of employers and procurement agencies, it can provide time-phased projections of the demand for occupations with sufficient lead time for local vocational and technical institutions to respond with appropriate training programs.

Institutional Responsiveness

The large investments in equipment, facilities, and staff required to provide specific kinds of occupational preparation inhibit the responsiveness of some public training institutions to changing labor market demands. Another major barrier to effective response is the alleged deficiency of information about current and future occupational changes.

Administrators of vocational education programs are reported to use a variety of information sources in making decisions to add, modify, or terminate training programs. They may rely on information from advisory committees, community and industrial surveys, and data on student interest and enrollments. Published data and occupational forecasts are often used by local administrators to verify program decisions already made, rather than to make decisions.

Often different sources of information are used to make different types of decisions. For example, locally conducted industrial surveys have a major influence in decisions to add programs. Advisory committees are very influential in affecting decisions to add programs or to modify existing programs. While patterns of student enrollment and interest are reported to be important for decisions to add or terminate programs, job placement rates of graduates are seldom used for decisions about program additions or terminations at the secondary school level.

A study of state plans and annual program plans for vocational education shows that, in general, state plans for vocational education, which include long-term (five-year) priorities for program development to meet training needs, do not reflect a clear relationship among program and enrollment goals, funding decisions, and employment needs. Neither annual program plans, which update five-year state plans, nor employment service publications demonstrate a sensitivity or awareness of anticipated shortages in specific occupational areas, such as the skilled machining trades.

In contrast to state-level agencies, local postsecondary and secondary vocational education agencies and institutions are reported to be more responsive to the need for skilled workers, such as those in the machining trades. This responsiveness comes about by design, or it may reflect student interest. In any case, the fact that the available supply of workers is not always obvious and that many different agencies train workers makes it imperative that vocational education planners be cautious in interpreting published and unpublished information about shortages of skilled labor.

Almost by necessity, proprietary training institutions have been willing partners with employers in offering training in anticipation of changing employment opportunities. Public training and education institutions do not appear to have the same survival pressures as proprietary schools to act in accordance with occupational forecasts. Because public training institutions are highly competitive, individualistic, and are capable of stimulating their own demand, they have few immediate incentives to restrict the training of workers even in the face of falling demand. While the lack of immediate penalties for glutting the market with skilled workers in specific occupations may sometimes perpetuate this problem, the prospect of declining enrollments and poor reputations would seem to be strong incentives for training institutions to adjust their programs to changing labor market demands.

Several states have taken the lead in developing training institutions that produce trained workers in order to attract employers to move within their borders. These states have used a variety of administrative approaches to provide state-level direction to subsidized entry-level training, upgrading of existing skills, and supplemental training. In most instances, the state vocational education agency has taken the lead in providing long-term financing of subsidized training. The responsiveness of state-sponsored training programs to the needs of specific employers is the result of a state's willingness to bear all or most of the costs of training for new and expanding firms. However, it is not possible to determine precisely the net impact that state training subsidies have had on employment within these states.

Anticipated increases in defense expenditures over the next several years have raised concerns that shortages of skilled labor in critical production areas may develop. The principal impact of defense growth will occur in the durable goods manufacturing sector. Shortages of skilled labor in key areas, such as mechanical and electrical engineers, tool and die makers, and heavy equipment mechanics, could cause production bottlenecks. Demand for engineers and electrical and electronics technicians is expected to be large in both defense and nondefense industries. Since it takes several years to train engineers, severe shortages could develop very quickly and be long lasting.

An examination of how other industrialized countries have responded to changing labor market demands indicates that those countries that have experienced shortages of skilled blue-collar workers are more aware of the implications for the education and training system than the United States. They have recognized that technological developments and changes in jobs and in the occupational structure require a better labor market information system if future shortages are to be avoided. In order to make their labor market information system more responsive, they collect and publish vacancy statistics. Official United States agencies do not collect vacancy statistics nor do they poll employers on a regular basis.

One of the outstanding lessons learned by other industrialized nations during the 1950s and 1960s is that a long lead time is required to design, establish, and staff education and training programs. In view of the United States' pluralistic skill development system, and our national policy of assigning the training of skilled workers to private employers and state and local authorities, national reactions to skill shortages may take longer than in other countries.

Program Coordination

Coordination in a labor market system involving many employment and training programs is both costly and time-consuming. The inability of each program to keep up with what others are doing is a major impediment to collaboration. The complexity of multiple and often conflicting objectives and missions also makes it difficult to coordinate activities.

The administration of programs requiring public-private coordination presents similar problems. The big administrative issues are not in deciding what to do, but in determining how to do it. Differences in goals and objectives, program administration costs, and complex rules tend to discourage participation by private employers in public training programs. The public sector must resolve the problem of designing a workable and efficient system if private employers are to increase their cooperation in training workers.

Coordination at the local level often exists without the direct intervention of state and federal guidance. Studies of coordination and linkages among training programs have concluded, almost paradoxically, that an important threat to the stability of local labor market coordination comes from continual efforts at the top level to create still more coordination.

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ROBERT E. TAYLOR, HOWARD ROSEN,
FRANK C. PRATZNER

Summary of Policy Considerations

One of the principal objectives of the series of Policy Forums is to provide policymakers at local, state, and national levels with information with which to make more informed decisions about this nation's system of education and training for the world of work. This volume presents many current policy issues related to the training of our labor force. The following policy considerations were derived from the papers presented at the second Policy Forum and from the discussions surrounding those papers.

OCCUPATIONAL FORECASTING

Federal personnel concerned with national occupational forecasting should make a greater effort to publicize their forecasts and make them more relevant and useful to local vocational educators and other users. Furthermore, forecasting agencies might consider adding to their publications a statement on the overall accuracy of their forecasts based on the evaluations of their past experience.

National occupational forecasts should be evaluated and revised more frequently. In making ten-year projections, intermediate projections for four- or five-year periods should also be made available.

Projecting labor requirements by geographic regions would make them more useful to local training institutions. Because of the high mobility of the American labor force, more attention should be paid to occupational and geographical movement affecting the supply of workers.

No one labor market model seems to be most accurate in predicting the future supply of workers. Complexity and size of models are no guarantee that they will capture the behavior of employees and students. Further experimental work needs to be conducted to explore the kinds of labor market models that might possibly be used to determine the future supply of skilled and technical workers.

The U.S. Department of Labor should continue to test the potential contributions of an early warning system that will alert education and training institutions to the need for skilled and technical workers stimulated by federal contracts, such as those issued by the U.S. Department of Defense or the National Aeronautics and Space Administration. The vocational education establishment may find such an early warning system to be a useful tool for planning training programs for occupations requiring relatively short periods of preparation. The early warning system can also be used to provide local job vacancy forecasts.

INSTITUTIONAL RESPONSIVENESS

Increasing longevity and the possibility of longer work careers may well point up the need for extended lifelong learning programs and educational opportunities for more mature workers. Tuition aids, sabbaticals, retraining, and skill upgrading are examples of the kinds of programs that may assist mature workers in adjusting to both technological changes and to extended work careers. Financial incentives, such as paid educational leave, could be offered to individuals, whether employed or unemployed, to encourage them to seek basic or advanced vocational training or retraining.

Greater dependence on imported goods is creating a need for an adjustment policy to shift workers with minimum disruption from declining to expanding industries. The use of such adjustment devices as educational or training vouchers, tax write-offs to firms for on-the-job training, and mobility assistance to workers might reduce the adverse effects of worker displacement.

Additionally, a voluntary levy-grant system or a training tax imposed on employers, modeled on similar European systems, might be tested in order to induce employers to provide basic or advanced vocational training or retraining. Employers could recoup their levy or tax if they provided training of a given length and standard.

Consideration also might be given to the possibility of establishing public training centers especially to serve small firms that typically have inadequate training programs. Such training programs could provide general skill training rather than specific skill preparation for particular firms. These training centers could be more flexible than established training institutions in length of training provided, entry and exit options, and curriculum offerings in order to be more responsive to the needs of students and the local labor market.

Public education and training institutions should develop programs that enable their students to acquire transferable technical skills useful in a variety of jobs and different industries. A related effort is needed to examine further the substitutability of workers with different skills in shortage occupations. Such an effort might provide employers, educators, and training specialists with information that can be useful in designing both jobs and training programs for meeting future occupational shortages. At the same time, the vocational education system should concentrate more on preparing students to take part in the move toward greater worker participation in work process decisions.

Vocational guidance personnel in education and training institutions should make greater efforts to encourage women to enroll in courses nontraditional for their sex so that they can fully participate in employment opportunities of the future.

Research should be directed to how the labor supply responds to occupations requiring different periods of training. Better information is needed on the effect of changes in wage rates and training times on the supply of workers. Education and training institutions should systematically follow up the employment experiences of their graduates, many of whom may seek employment beyond local labor markets. The adjustment of local training efforts to the labor market experience of graduates should be monitored constantly.

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PROGRAM COORDINATION

Better coordination is needed in the collection, dissemination, and use of occupational information at local, state, regional, and national levels. At the local level, consideration should be given to improved arrangements for two-way communication between schools and employers, such as through "Community Occupational Information Coordinating Committees," "Account Managers," and cooperative education programs. Account Managers, concerned with improving the transition of students from school to work, should relate specifically to individual employers by visiting them regularly in order to learn about their hiring and training needs. This information should be fed back regularly to local training institutions. At the same time, employers should be informed about the type of training being provided and the number and availability of trained workers.

Although a completely integrated labor market system is neither feasible nor desirable, there still remains a need to implement better processes for shared information, consultation, and control where barriers to coordination are surmountable. However, proposals by state and federal agencies to integrate local education and training programs or to require coordination among them should be considered seriously only when they are accompanied by a description of how the local training programs now operate. Otherwise, they may disrupt on-going, coordinated programs. Many local systems that appear to be fragmented may be part of a well-coordinated process based on informal networks among participating organizations. Local training programs should not be restricted by inflexible rules that do not permit them sufficient discretion to develop innovative solutions to conflicting objectives.

The continued growth in private sector training requires far more research and examination than has been devoted to this subject up until now. More information is needed about public-private training partnerships that have effectively satisified local labor market needs.

States that are interested in subsidizing training in order to attract new employers should examine the experience of states that have followed this course of action but should move cautiously in adopting these programs. It is difficult to measure the net impact of state training subsidies on intrastate employment. Glowing assertions of tremendous increases of employment, earning flows, and tax revenues because of the commitment of state resources to subsidized training have not been proven.

In spite of continuing problems and issues related to occupational forecasting and program coordination, the second Policy Forum concluded that, on the whole, the nation's pluralistic skill development system operates fairly well in providing training for the world of work. The Forum examined alternative views of needed improvements in occupational forecasting and program coordination and presented a variety of options and recommendations for improving the responsiveness of our education and training institutions to changing labor market demands. Those alternative views and options for improvement are discussed in the papers and reactor comments prepared for the Forum and presented in the following chapters of this volume.

PAUL E. BARTON

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Responding to Change: Occupational Preparation in the 1980s

THE CONTEXT

My assignment is to speak to you about how vocational education and training can be responsive to change in the 1980s. To be invited to speak about the future before a captive audience is license for wild speculation . . . from the labor market implications of computers getting high scores on their Turing Tests for artificial intelligence, to the possible obsolescence of social science researchers—such as those here assembled. The temptation is to plunge into speculation about an altered society and economy in the future, and how education should respond. I hesitate. The plunge could be into a dry pool and the speculation no more than a mildly titillating diversion, unless we have a clear view of the *context* of occupational preparation in America today.

Whatever we actually *do* as opposed to what we merely *talk about* at conferences will have to be based squarely on recognizing the limits to institutional change that are our reality. In short, we must be fully aware of the context in which institutions must try to be responsive, in the present and in the future. I emphasize, however, that the limits we find in this context are not necessarily a barrier to creativity. The creativity we need is to find paths to greater effectiveness despite the limits that do exist. Rollo May puts it the following way in *The Courage*

The statements and views expressed herein do not necessarily represent those of the Trustees of the National Institute for Work and Learning.

to Create: "The limits are as necessary as those provided by the banks of a river, without which the water should be dispersed on the earth and there would be no river—that is, the river is the banks" (p. 115).

The stern test, and the only one of use to policymakers, is that we contend with the whole of the culture in which education and training occur. I will summarize my own perspective on this context briefly:

1. While we need not project the kind of budget cutting we've seen in the last two years, it is reasonable to expect that public skill development program budgets will remain tight in the near future.

2. Corporations' training expenditures are cyclical and are the first to go when the so-called "fat" is trimmed.* In a lower growth economy we will not see any large spurt in private resources devoted to skill development; that is, unless a conviction develops that this training is a substantial factor in productivity and a significant element in improving competitiveness in international markets.

3. Public education is riding low in public esteem, and the increasing percentage of households without school-age children is narrowing the base of financial support.

4. Employers and educators hiss at each other, "The schools aren't teaching basics" and "The employers don't help the schools." However, I sense that the climate for working together has recently improved.

5. In general, the force of the industrial revolution has been to deskill the workforce, and of the technological revolution to replace labor with machines. This is not the kind of history that stimulates careful attention to developing human skills, so we continually find ourselves underproducing in that segment of the economy where skill requirements are large and growing.

6. We have failed to develop a strong system of labor market information available at the local level; we have failed to follow through on the development of a job vacancy measure; and the data base we do have is now being eroded by budget cuts.

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*I should note however that we may be getting more stability of investments in the high-technology sector of the society.

7. We started down a path in 1962, under the Manpower Development and Training Act, to work toward better means of balancing education and training supply and demand, but this path has come to a dead end at a dense forest marked "poor people only," a forest we have barely succeeded in penetrating.

There are, to be sure, some bright spots to relieve the gloom: Community colleges have grown and represent a flexible supply institution; vocational education generally has, between 1963 and 1982, become more attuned to the job market (although it can still play off-key); the large high-tech firms are showing the rest of industry how to take human resource needs seriously; the quality of work life/work innovation fledgling "movement" is adding a new and needed dimension to the development of human resources; and the subject of "business-school partnerships" has become this year's fad for conferences and projects.

But the culture into which we plant the germinal ideas for greater responsiveness and adaptability is not a rich one. The education and training supply institutions are rooted in an environment that does not particularly encourage a vigorous adjustment to changing needs. It is necessary to change this whole environment. It is necessary to stop the retreat and create a larger awareness of the consequences of the declining effectiveness of labor market mechanisms, of crippling shortages of technicians and engineers, of declining ability to reverse slippages in math and science achievement in the schools, and of the many displaced workers without skills that the still-growing sectors of the economy need.

RESPONDING TO NEED

I do not propose that we be paralyzed with dismay by this chilly climate in the human resource development/labor market field. Quite the contrary; there is an even greater need for action to use available resources and institutions more effectively. The sum of the parts of the system we now have does not a whole make . . . but we need at least to start summing them up and finding a better fit among them. We need to be aware of the steep river banks that create the limits within which we have an opportunity to churn a very swift river. The test of new means for increasing responsiveness ought to be a practical one, to tell us whether they are attainable, not whether they are ideal. I will suggest a few means to which this kind of test can be applied.

1. **Responsiveness can be achieved through greater integration of curriculum planning and job market information systems.**

If we look at the last fifteen or twenty years, I believe we have made progress here. A careful examination of occupational trends as compared to vocational education enrollments prompted the 1963 Vocational Education Amendments. The 1968 Amendments provided some funds for better information for curriculum planning. The Bureau of Labor Statistics (BLS) worked cooperatively with the U.S. Employment Service to develop techniques for translating national projections into state projections. The BLS developed a new time series on employment by occupation. The National and State Occupational Information Coordinating Committees (NOICC and SOICCs) have brought a dimension of sophistication to the development and coordination of occupational information.

Despite these advances, few would claim that we have fine-tuned curriculum offerings to match demand as it exists. And we should recognize that the skill-producing system is not alone in this regard: Detroit produced big cars long after preferences shifted to smaller ones.

I have three candidates for subjection to a reality test in this area:

- I suggest establishing Community Occupational Information Coordinating Committees. The majority of public and private curriculum decisions are made at the local level. Yet the new forms of coordination among suppliers and between suppliers of skills and users of skills take place principally at the national level (in NOICC) and at the state level (in SOICCs). I propose a local counterpart: Community Occupational Information Coordinating Committees.

- I suggest the use of account managers. We should use statistical series and occupational projections for a broad picture of change, but public occupational training institutions should have account managers who relate specifically to individual, local employers, visiting them regularly, finding out what their hiring and training patterns are, and finding out how the schools' graduates are doing, what the employers want changed, and how production processes are changing. Keeping up with the market is an operating problem for training institutions that can be solved only if representativs of these schools know the local employers intimately.

- I suggest that we go beyond occupational projections. The discussions and actions of the last fifteen years on better use of occupational information in curriculum planning have focused principally on the production and use of projections of growth in particular sectors of the economy and in specific occupations. The state of the art of creating and using such projections by vocational educators is well set forth by Harold Goldstein in his recent paper commissioned by Henry David of the National Institute of Education (Goldstein 1980).

  But these projections represent only one piece of information for curriculum planning and adjustment. An occupation that is growing is not necessarily an existing market for public occupational education in a particular community. And a stable occupation may well be a potential market for vocational education. For particular industries and particular firms in specific communities, we need to know whether graduates will be hired if they are trained, or whether firms prefer to do their own training. Such information as we collect needs to be useful in day-to-day operations, and not be at the level of aggregation usually attained by carefully constructed statistical series. So I am talking about *systematic* tracking of employer preferences and practices, not about national statistical series, and I am talking about informal means of gathering such information, not just about standardized questionnaires.

  Such information could be obtained by the account managers I just described, or arrangements for its collection could be worked out by *Community* Occupational Information Coordinating Committees. Or it could be done in some other way. The maximum advantage would be achieved if the arrangements provide for two-way communication between the schools and the employers, so that as schools learn how firms operate, firms learn what the schools can do for them, and adjustments can be found that are desirable to both sides.

While I am talking about operating and planning information, I should point out that I do not mean to rule out the need for statistical studies on employer hiring and training practices. There have been too many analyses of what such practices in the United States are that have been based on too little reliable information.

2. **Responsiveness can be achieved by making a better fit of the pieces.**

If we are to make the whole of skill development something larger than the sum of its separate parts, we will have to identify those parts and fit them together better than we have in the past. Last year's Policy Forum on Employability Development held by the National Center for Research in Vocational Education went a long way toward identifying the components of the skill development system. If anyone holds out the prospect of some *complete* integration of these parts into a single comprehensive system, I would say that this is not even a remote possibility, nor even a desirable one. The skill development system, like most ways of approaching things in the United States, is pluralistic. Some of its vigor is most likely due to the diversity in the system, the competition of approaches, and the variety of choices young people have in the routes they can take to jobs.

But I would advance the proposition that there are a number of good candidates for sharing responsibility, for conserving resources, and thereby for enlarging the opportunity for both young people and the economy as a whole to respond effectively to changing skill demands. I will next identify what I think these possibilities are although time and space do not permit their full development.

- Joint employer-school occupational education. The potential of cooperative education-type approaches seems to me to be both well developed and well tested. I think we need to investigate what is blocking their spread. I have yet to see a convincing argument that this sharing of responsibility is not beneficial, yet there is no trend toward conversion from straight classroom occupational education to cooperative education, except perhaps in community colleges.

- Joint apprenticeship and secondary-postsecondary programs. The experiential mode of apprenticeship training can be combined with regular degree programs in a "dual enrollment" approach. One excellent example is the Dual Enrollment Program of the International Union of Operating Engineers and a number of community colleges.

- A better fit between secondary and postsecondary education. Resources can be better used and opportunities for an orderly progression of skill development created through better cooperation between high school-level programs and two-year and four-year postsecondary programs in occupational education. This is already done in many communities, but the potential remains huge. Agreement is needed on where each institution starts and leaves off along a continuum of skill development. Students should also be made fully aware of how they can progress from one level to another.

- Contracting with industry and vice versa. Bay de Noc Community College in Michigan contracts with local industry to provide occupational training to its students. Industry contracts with the Milwaukee Area Technical School to come into the factory and upgrade the skills of workers. There is potential for such integration that has so far been only barely tapped.

- Joint armed services-occupational education programs to prepare for civilian occupations. Military occupational specialties have been classified according to their nearest civilian counterparts, using the *Dictionary of Occupational Titles* system. The next step should be to identify further what extra training will more effectively equip a person in a military program for a civilian job. The military could contract for the supplementary instruction and recoup the expense from the recruitment advantage it would gain from being able to promise training in skills that match civilian jobs. Another approach would be to do this through the tuition aid programs of the armed services. Training experiments could establish the feasibility of such integration.

- Collaboration to make industry tuition aid programs work. While programs in which employers reimburse employees for the costs of education outside the firm are increasing, the employee utilization rate remains low. These programs afford workers of all ages with a means of continuing their education and training. Joint effort among employers, unions, and educational institutions can help these programs reach more people.

3. **Responsiveness can be achieved through collaboration.**

We will not be able to sit in offices or conferences in Washington, DC, and invent the means by which the nation's skill development efforts will be more responsive to the needs of people and the economy.

The only sure and lasting way is to create a *process* in which trends and needs can be identified, and to have the key decision makers talking to each other and working together. Those of you who know the Institute with which I am involved, the National Institute for Work and Learning, know that the use of the collaborative process is the Institute's principal approach to education-work issues and activities. We recently issued a directory with profiles of 150 collaborative councils, for which we use the generic term industry-education-labor councils (Gold et al. 1981). They have many different names and acronyms, but all are serious efforts to bring these sectors together to produce a better education and training system. The Institute has also published an "action guide" for creating and operating such councils (Elsman 1981). I will not belabor the need for such a process here; the Institute will be glad to share what information and experience it has in this area.

The variation among the numerous cities, towns, and rural areas of the United States, and the variations in the industries and businesses located in these places, is so vast that the only way to achieve responsiveness is through some process that continually brings the key users and suppliers of trained workers together. The content of what they decide among themselves cannot (and should not) be dictated, but the creation of collaborative processes can be stimulated and nurtured.

THE FUTURE

I approach the assignment of looking into how changes in the future may affect education and training with some trepidation. Humility is in order, of the kind shown by the best futurist around, Willis Harman, in his delightful book, *An Incomplete Guide to the Future*. But it is not so much the inevitable trepidation of trying to imitate the Oracle at Delphi that gives me pause; there are two other reasons for reticence, and they are interrelated.

One is that the task of looking into the future and predicting the impact of change on a particular area of government or private enterprise has become a standard element of conferences. I think this activity is valuable, but at the same time I wonder about how useful it is from the standpoint of the process by which we change institutions, or—in the context of this conference—how much it helps us increase the responsiveness of occupational preparation to the needs of employers and the economy in general. Power in the United States is so diffused, among federal, state, and local branches of government, between school boards and school administrators, among the several levels of the educational system, and between public and private institutions, that I am not optimistic about our ability to act *now* to prepare effectively for something we only *expect* to happen in the future.

My own experience in watching policy respond to change is that it is very hard to adjust to *present* realities, and that we even find it hard to catch up with the past. In the skill development area, I offer as an example the situation in 1963 when vocational education was examined and the law was changed to do something about the fact that a large proportion of public funds for vocational education were still concentrated on training for agriculture, when the agricultural sector had been in decline throughout the century.* I am reminded of something Daniel Patrick Moynihan said to me quite a while ago, that to get something done in our country, you not only have to show that a problem exists, but that it is getting inexorably worse every year. We properly abhor the kind of centralization of power that permits rapid responsiveness to change, and so we take the longer and surer route of educating as many decision makers as we can in the lessons the present offers and in what the uncertain future may portend. For disseminating such information widely, I commend the approach used by the U.S. Department of Labor in the early 1960s, when it published the widely used booklet called *The Manpower Challenge of the 1960s* (U.S. Department of Labor, 1960). Perhaps such a document could be distilled from your proceedings here.

My second reason for reticence about forecasting educational futures springs from my belief that the greatest opportunities for creating responsiveness already exist. These opportunities are rooted in what we know about the present, or in processes and forms that are created to facilitate responsiveness to future developments as a matter of course, or they spring from the enduring tensions among the involved parties, or arise from the ambivalence between our larger visions of human potential (for which we advocate general education) and the here-and-now realities of the industrial society in which we live (for which we advocate up-to-date occupational preparation).

I have already discussed processes to build in responsiveness. With respect to enduring tensions between the public interest as represented in public education, and the national economic or corporate interest in skill development, we can be reasonably sure that they will be with us ten or twenty years from now. We will not find a neat formula for deciding what portion of skill training should be paid for by the public and what should be paid for by private companies or by individuals. The larger public interest is served, we hope, by the balancing of competing claims, as was described decades ago by David Truman in his book, *The Governmental Process*. I do sense that we are entering a period of much greater consciousness about these choices,

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*In using this example, I am fully aware of the growing role of agribusiness and the relevance of vocational education to that industry.

- As public skill development institutions strive for greater rapport with and support from the corporate community

- As skill shortages become more identified with barriers to increased productivity, and as industry becomes more and more concerned with slipping achievements in basic math and science skills in the elementary and secondary levels of education

- As industry finds its investments increasing in remedial education, and in education and training generally*

- As public funds for education and training become more scarce

We can be sure that in the future, the "head and hand" debate will continue unabated. It is a healthy debate, with the balance struck differently in different eras. We remain dedicated to general and liberal education because we recognize that only through it will the accumulated knowledge—and values—of civilization be passed on. And we are dedicated to it because we know that only minds taught to think—and equipped to think—can invent a future hospitable to homo sapiens.

But because we live in an industrial, technological, service-consuming age that requires many thousands of specific occupational skills, there are also clear roles for both the public and the private sectors to be providers of those skills. Yet there are strong voices raised against the expenditure of education funds for vocational education by people who argue either that it can (or should) all be done by the private sector or that *only* general education is appropriate for equipping young people to join society. I have to say also that there are vocational educators who have contempt for general and liberal education and believe it has little value in the practical world.

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*However, we do not have reliable information on industry expenditures for education and training over time.

This polarization of viewpoint is significant, and it may well be a larger element in the next decade as the education and training "pie" shrinks. We need a better understanding of the deep wells from which these strongly held views are drawn. I believe we need to seek a larger consensus for the proposition that general/liberal education and occupational education are both quite necessary and that our effort should be to strike a balance that best serves the economy on which we depend and the human purpose expressed in the poetry of Robert Browning: "Ah, but a man's reach should exceed his grasp, or what's a Heaven for?"

Let me mention another element of this tension between general and occupational education that is becoming more significant. It is the degree to which better education in the basics—in reading, writing, and arithmetic—becomes itself a critical element of "occupational education." We have a long history of cycles, as Rupert Evans (1971) has well described, of separating vocational and general education at the high school level and of later bringing them together again in comprehensive schools. It is critical that vocational education students be well grounded in the basics, and we need to evaluate the performance of vocational education as much in this area as we do in specific occupational skills.

I believe that more responsiveness in such *integration* of occupational and general education will be a stronger demand in the future. This will result from a combination of more general demands for "higher standards" in education and increasingly vocal employer complaints that graduates are not well equipped in the basics. We have a competent National Assessment of Educational Progress program that provides the nation trend information on educational achievement. We should identify the vocational education students in the biographical data collected in those national assessments and start tracking how well these students are doing in reading, writing, and mathematics—information not currently made available.

There is another balancing act likely to grow in importance in the future: the balance to be struck between valuing the occupational skills that are acquired in the classroom and those that are acquired from experience. I submit to you the following warning:

> As societies become more complex in structure and resources, the need of formal or intentional teaching and learning increases. As formal teaching and training grow in extent, there is danger of creating an undesirable split between the experience gained in more direct associations, and what is acquired in school. The danger was never greater than at the present time, on account of the rapid growth in the last few centuries of knowledge and technical modes of skills. (Dewey, 1963 p. 9)

The problem of which this author has written is sure to be greater in 1990 than in 1982. Yet this warning was given by John Dewey, five decades ago. And in the last fifty years the warning has not been sufficiently heeded; the distance between the classroom and the work place remains large in many sectors of formal occupational education. Our educational systems become ever larger. The kinds of skills that require long lead-times to develop for use in large national and multinational corporations continue to grow in number. The pace of technology quickens as the applications of the silicon chip penetrate ever more deeply into American service industries as well as manufacturing. Engineering students today read about CAD-CAM in *Time* magazine and find that the curriculum in their schools and the equipment available for their instruction have not kept pace with the present, let alone the future. The students who do have exposure to new technology are likely to be those in engineering schools that use the cooperative education approach, or who leave school for the direct experience in the work place that puts them ahead of their colleagues. The half-life of early occupational training compresses, and a continual interplay of formal education and experience becomes necessary throughout a career. The future, I believe, holds the prospect of a greater integration of live experience and formal instruction.

It all comes down to just one point: In many respects the future can be amply discerned through a careful examination of the present. We do not have the luxury of forecasting the future and then just waiting for it to happen. The stride of the future has at least one heel print clearly visible, marking a path that is likely to lead to a lot more of the same. With that in mind we can act now, rather than react later.

With that said, we can step a little less gingerly into predicting trends in the decade ahead. There is the prospect of large changes in the structure and management of work processes in a broad spectrum of industry. As this change proceeds, it will inevitably affect the occupational education system. In curriculum content and approach I do not know what impact these changes will have, but it is time to start thinking about them.*

I may well be wrong about the pace of change in the new structures to which I refer, for they will come about only if we exercise the choices before us. They are not preordained as is the changing demography of the work force based on babies already born, or the inevitable march of robots into factories to help match the competition with Japan, where they are increasingly deployed. The terminology for the new structures has itself not settled down. Jerome Rosow, a leader in this field, speaks of it as "quality of working life and productivity." That terminology has been blended with "quality circles" imported from Japan. A variation on this theme is well described in the book, *Theory Z* (Ouchi 1982).

Involved in all of these is the pushing down of decision making to work teams. These work teams decide on how to approach production problems, and they also decide on how to organize themselves to perform the required tasks. For the individual members of these teams, the content of their work may come to vary greatly from the standardized job descriptions in their firms. The job content is not likely to remain constant, as assignments are rotated or the approach to the task itself is altered.

It is hard to predict how fast these practices will spread. They exist in both union and nonunion firms. In the unionized sector they are the result of union-management collaboration and cooperation and are now embraced by the United Auto Workers of America and the General Motors Corporation, as well as by two other major collective bargaining agreements. They are widespread in Hewlett Packard and TRW. Further growth of these practices in the unionized sector remains dependent on how these cooperative styles can be made to fit with the adversarial nature of collective bargaining, and how unions can be assured that such approaches do not have as their principal purpose the undermining of collective bargaining.

At least a couple of the implications are fairly obvious. As the occupations—that is, job descriptions—in these work teams become less standardized and more subject to change, there is the question of how that will affect training in curricula based on more predictable job content. As workers are expected to participate more in problem solving and decision making, a greater premium will be placed on broad preparation as compared to narrower skill training. Workers may well need to know more about the whole of the business or the dynamics of the industry than about a single occupation.

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*I would speculate that the need will be for more teaching of problem-solving skills, teamwork methods, and knowledge of how organizations function.

Training for many of the jobs now calling for participatory work teams is not available in the public classroom, but as the use of work teams extends, more will be. These changes have implications for corporate education and training departments as well as for public occupational training. Aside from training for changes in the skill content of jobs, there is a new need to train workers and supervisors for participation in work teams.

There is an aspect of the future almost never discussed in vocational education circles. If it enters consciousness at all it is likely to be handled much the way discussions of death are handled in front of young children. Stated baldly, the fact of the matter is that in the economy of the late 1980s, *there will be millions upon millions of jobs in the United States that require minimal training, although a growing portion of these jobs will require literacy and "numeracy"* (i.e. reading, writing, and computational skills).

Those of us engaged in the professions represented at this conference have done a great deal of talking about the growing complexity of jobs and the way technological change creates jobs that require advanced education and training. It is appropriate that we do so, for occupational education is nurtured by such trends toward complexity. But there is another long-term trend superimposed on this one, and it extends well into the future. To draw a sharp contrast between these two trends, in this decade, the occupation with the largest growth *rate* is that of data processing machine service people, but the occupation with the largest *numerical* increase is that of janitors.

The trend to which I refer is the creation of jobs that require few skills needing formal instruction; that is, the breaking of whole jobs into small tasks, as on assembly lines; the effect technology has of changing skilled workers into machine tenders and gauge watchers; and that growing element in the service sector that produces jobs with low skill requirements (such as money takers at self-service gasoline stations).

We know that the content of occupational education does not itself shape these trends. We want each young person to be prepared for a job that uses his or her highest abilities. We know that we want to avoid forcing any premature decisions on young people that close off their options. But from the perspective of educators, and particularly of vocational educators, how should we view this large segment of the economy that requires little formal education? I do not propose to answer the question, only to frame it. Where does it fit in a discussion of the responsiveness of vocational education?

I think I need to touch only briefly on the matter of lifelong, or continuing, or adult, or recurrent education (whatever your preferred lable is). It is broadly understood that in the large sector of the economy that is affected by technological change, one round of occupational education and training does not a lifetime last. The need for retooling and skill upgrading is increasingly reflected in the offerings of the occupational sector of postsecondary education and in the continuing growth of enrollments of adults in these courses.

It may be useful, however, to point out that what the future holds in adult education will be as much the result of initiatives *we* take now to shape opportunities as the result of forces coming from the demand side—that is, adults with increased propensities to seek education. I will only highlight a few of the tasks before us if greater opportunities for adult learning are to be realized:

- A better understanding of how to make industry tuition aid programs work better

- A better understanding of the patterns of adult participation in education and the barriers to participation

- A clear policy of government participation (at all levels) in the creation of retraining opportunities for dislocated workers who need them

- A recognition of the waste involved in letting skilled and professional workers in industry become obsolete because of insufficient public and private investment in skill upgrading

It is also my assignment to comment on some other matters that we shall, with some certainty, face in the decade ahead. They are important matters, and I have saved them for last because they have already been much discussed by others: the continued movement of women into the labor force, the decline in size of the youth cohort, and the increasing unwillingness of older people to take their gold watches and go home.

None of us here has much doubt that women will continue to press for occupational parity and that the well-established trend (for which the Bureau of Labor Statistics plots a too-conservative trend line) of women's increasing participation in the labor force will continue. The spurt in the entry of women is a formidable challenge to the occupational system, and of course it must be met. I have only a few observations to make about this challenge:

- It is clear that many of those who hire continue to have sex preferences even as more blatant discrimination diminishes. On the one hand, educational institutions will be blamed if they overtrain women relative to the market's readiness to absorb them. On the other hand, employers who are eliminating sex considerations in their hiring will be blocked if the schools lag in enrolling females in courses that lead to traditionally male occupations. This is just one more reason why occupational education institutions and employers need to be in closer communication.

- It is clear that women will not suddenly become homogeneous about their desired roles in the occupational structure. Within politically active women's groups, there is a polarization into proponents of tradition and proponents of change. I think the situation will require a combination of unusual responsiveness and sensitivity on the part of educators until a greater consensus is achieved. In the meantime, *no* female who has developed a desire to enter a particular occupation should *ever* be directly or indirectly diverted from it because someone in an educational institution still has one or both feet planted in the past.

- After being sure education has its own house in order, it becomes appropriate for educators to repel any blame they receive for the sex discrimination that remains on the hiring side.

It is ironical that when the youth age cohort was large and moving through the schools, we saw enormous problems for both the schools and the economy. The expansion in the schools raised expenditures, the needed teachers were in short supply, and we asked, "Where are the jobs going to be when they all leave school?" Now when the youth age cohort is declining, we bemoan the school budget cuts that result, and we worry whether there will be enough trained young people to meet industry's needs. We grew accustomed to a surplus of entry workers, and most of the subject matter of conferences and policy changes in the last decade focused on what vocational education was going to do about youth unemployment. Attention to the quality of education for jobs with the highest qualifications and to whether we were meeting the nation's needs were likely to be countered with some variant of the statement, "Well . . . these youth will do okay by themselves; we have to aim the resources at those at the bottom of the income, achievement, and motivation scale."

Now, I am among those who participated in such discussions; I am among those who still believe we need to work harder on youth unemloyment in the cities and in rural areas; and I am among those who argue that the decline in the youth age cohort is not going to solve our youth unemployment problem for us. But none of this justifies taking our eye off other critical educational needs, such as—

- the need to develop advanced skills in the higher achievers among our youth,
- the need to improve the quality of occupational education for mainstream youth,
- the need to stay closely tuned to the skills industry is asking for, and
- the need to reward success as one way of creating strong incentives for all youth to achieve.

In the decade ahead we must find a better balance between the intensive remedial effort to help youth at the bottom of the barrel and the mainstream effort to bring the skills and abilities of entry workers into line with what an economy with its back to the wall is demanding.

As the youth cohort shrinks, the older worker cohort swells. Older people have generally been connected with education principally as attendees at high school and college graduation ceremonies for their offspring, or as recipients of school pictures from their grandchildren. Now, they are refusing to be sidelined at age sixty or sixty-five. Their political power is well recognized by those who seek office, and has been sufficient to pass a law prohibiting mandatory retirement before age seventy. That law itself has large implications for education, as older workers need to update their skills in order to be worth the wages employers must continue to pay them. While the rate of educational participation among older people in education remains low, it has been slowly rising. How fast it rises will depend on whether schools open their doors more widely to older people, whether employers continue to invest less in training with the rising age of their employees, and whether the Grey Panthers turn their attention to the issue of broadening education opportunities for older citizens.

Having said all this about the future, I will remind you that most of the futures that have been projected have been wide of the mark. The only confidence we can truly have is that the future is indeed before us, and that our action—or inaction—now will help shape it.

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Occupational Projections

4

HAROLD GOLDSTEIN

The Accuracy and Utilization of Occupational Forecasting

THE NEED FOR FORECASTS

Accuracy and utilization are two closely intertwined subjects: we cannot evaluate accuracy without considering how accurate forecasts have to be for the uses contemplated, nor can we use them without knowing how accurate they are.

Occupational forecasts are used for several purposes:

1. **In choice of careers by individuals** who have to consider the return on their investment in long periods of training, including the probability of getting a job as well as earnings.

2. **In planning education and training**, as in the case of vocational education and human resource development, in which the basic legislation has emphasized the need to ensure that the training is realistic in light of anticipated employment opportunities.

3. **In assessing the adequacy of skilled labor** for major programs identified as policy goals—such as defense, energy supply, housing, space exploration, health services, and scientific research. The assessment has frequently led to policies and programs to encourage or assist students preparing for the occupations required.

While the market takes care of the problems of worker allocation for occupations that have very short training periods, for those requiring several years of training there has to be a lag between the market's signals and the inflow of trained workers into the supply. The market can operate better if individuals have forecasts on which to base their investment decisions and if authorities have forecast information by which to plan the provision of facilities and incentives for training. Thus the forecasts are needed mainly for professional, technical, craft, and other occupations requiring long periods of specific training; these amount to about one out of three jobs in the United States.

The information needed for these various uses differs somewhat. For educational planning and for labor assessment for major programs, estimates of the total training needs for the economy are needed (not just for the specific program). This is the sum of the necessary annual growth in the occupation plus replacements for losses (deaths, retirements, withdrawals from the labor force, and the net movement to and from other occupations). All of these factors have to be estimated in the context of the prospective market situation. For individual vocational choice, less-quantitative information is needed: for example, general trend information concerning whether employment is growing rapidly or slowly, whether it is declining, and what the competitive situation for entrants will be several years ahead when the individual's training is completed is adequate.

The information needed for occupational forecasting includes the prospective flow of graduates into the occupation. Students already in the pipeline can be taken into account (with allowance for some flexibility in course choice and for slippage). Those not yet in training, who will not come into the labor market for several years, are subject to the influences of whatever labor market information they consider, including the forecasts themselves. It is a logical anomaly, therefore, to expect the forecast to predict their numbers. The National Center for Education Statistics makes projections by extrapolating past trends in the choice of courses by college students; such estimates serve only to illustrate what the supply of graduates to each field would be in the absence of economic change and student response to market signals. These illustrative estimates, when compared with the independently projected requirements, point to the directions and magnitudes of the adjustments that will be required to achieve a labor market equilibrium: student choices of courses may respond to the employment opportunities indicated; authorities responsible for achieving national programs may help this response along by providing student aid or expanding school facilities; and employers may adjust their staffing and production methods, insofar as they are flexible, to the expected supply.

For some of the purposes for which projections are used, nationwide projections are suitable, but for others, data for states or substate areas are more relevant. Local projections are more helpful than national for occupations that have primarily local markets, such as some craft and technical occupations. Most professional occupations have national markets, but even among these are occupations more oriented to local markets, such as nursing. At the same time some education officials, responsible for planning vocational education in their areas of jurisdiction, such as school districts, cities, or counties, have asked for human resource projections for such areas even though broader regions, such as metropolitan areas of which they are a part, are more realistic as labor market units. For planning purposes, it would be more realistic if educational jurisdictions within broader labor market areas were to plan their programs jointly in the light of the human resource demand and supply for the whole area.

HOW FORECASTS ARE MADE

This subject will be treated briefly and only as it bears on the evaluation of the accuracy of the forecasts.

We have used the terms *demand* and *supply* in a sense different from their usual meaning in economic analysis, which is, of course, the quantity demanded and the supply elicited at a particular price or wage, with the concept that both are more or less elastic and rise or fall along a curve in response to changes in price. In practice, most projections of "demand" begin by projecting the *requirements* for workers in each occupation that would be generated by an expected general level of economic activity with existing or expected patterns of economic relationships (such as the patterns of consumer demand, investment, and government expenditures; relationships of labor and other inputs to production in each sector; average hours of work; and occupational composition of the work force in each sector). The requirements thus estimated are then subject to modification to the extent that they are elastic with respect to wages and the supply of skilled workers. The actual level of employment in the forecast year may thus be different from the projected requirements.

In forecasts made for the purpose of educational planning, no independent projection of supply is made, since the aim is to provide a flow of graduates approximately adjusted to the requirements. On the other hand, projections to aid in vocational choice and those made to assure workers for major programs require an assessment of the prospective labor market; they make judgments about the supply on the basis of the general labor market situation anticipated, past experience in the behavior of workers in the individual occupations, the relative attractiveness of occupations, wage rates, and other factors. Such projections, if people pay attention to them, should have the effect of bringing supply closer to the projected requirements, since the number of students choosing each field is usually flexible in response to perceived employment opportunity, as Richard Freeman and others have shown.

Projections, as they are made in federal and state agencies, begin with a set of assumptions about the general social, political, and economic climate in which economic growth will take place, usually ruling out major discontinuities, such as wars, petroleum cartels, revolutions, depressions, and other catastrophes—not because they don't happen, but because their timing and effects are too difficult to predict. The basis for projections, therefore, is a peaceful world in which only the slow pace of social and technological change is affecting the economy—that is, a world we have seldom seen.

Even within this leisurely world dragons roam; events difficult to anticipate make the forecaster's life a risky one. Unpredictable scientific discoveries create new industries, change production methods in existing ones, and make some obsolete. Events in other countries affect their exports to the United States and our markets abroad. Consumption patterns change with life-styles: ask any barber, shaving cream manufacturer, or retailer of men's tailored clothing.

Fortunately, some of these changes move slowly, so they can be anticipated by an alert forecaster. In the 1950s, when the possibility of computer-controlled machine tools was first discussed in the industry, the Bureau of Labor Statistics (BLS) had an economist chasing all over the country trying to find the first one and see what effect it had on the skills machinists needed. Similarly, current changes in birthrates make it possible to predict the demand for teachers and other school personnel for twenty years ahead.

If one is projecting for a single occupation, a method frequently followed is to examine the relationship of the numbers employed to causative variables, or those that may be proxies for causative variables, through regression analysis.

Agencies, such as the Bureau of Labor Statistics and state employment security agencies, making projections for large numbers of occupations have found it worthwhile to use a more complex system. The general approach is to project, within the assumptions stated, the growth of population and the labor force, the level of civilian employment (allowing for an assumed size of the armed forces and an assumed—usually low—unemployment rate), and the long-term growth of productivity and changes in work hours, and so calculate the gross national product a fully employed work force would produce in the forecast years. Sometimes a few alternative projections are made on different assumptions to show the sensitivity of the projections to a reasonable range of possible scenarios. The GNP is then allocated among its major components, such as consumer expenditures, private investment, and government expenditures, by use of an econometric model. Consumption patterns are used to estimate how much demand would be generated for each type of product or service. The needs for raw materials, components, transportation, and other services required for those levels of production are estimated from an input/output table showing what each industry buys from other industries to make its products. The production levels in each industry, estimated in this way, are translated into employment requirements by projecting ratios of workers per unit of output. Total employment in each industry is then allocated among occupations on the basis of data on the occupational composition of all industries. The requirements for each occupation in all the industries are then summarized. (Sources for this discussion include U.S. Dept. of Labor 1976, pp. 24-25, 49-62, and 256-257; and U.S. Dept. of Labor 1980.) One advantage of the use of a method involving the entire economy over the use of regression methods to project a single occupation is that the projection for each sector and each occupation is both constrained and illuminated by its relationship to others; it fits within a web of economic relationships and so the results are likely to be more realistic than when a single occupation is projected.

At each step in this process, the ratios and relationships used in a projection are not the current ones or those for past periods when the data were compiled, but rather projected ratios, changed to represent what is likely to occur in the forecast period, taking into account trends in the ratio in the past, technological changes that have been occurring, and other factors. Much of this is based on judgment rather than scientific methods. Inevitably the projections are affected by market changes and price effects that have generated the trends observed. Such projections have been called "fixed-coefficient" projections, but this is true only in the sense that the effect of prices *in the forecast year* on the relationships is not explicitly estimated. Of particular concern is the effect of the labor market situation in the occupation upon demand. We may hypothesize that in many occupations there are rigidities (the occupational mix required by the technology in use, the capital investment, wage structure dictated by labor-management agreements or equity-seeking company policies) that keep demand fairly inelastic to moderate changes in the market. More research on the wage-elasticity of demand in various occupations is needed.

The source of data on the occupational composition of each industry had been the decennial censuses of population until the 1970s, when a new collection of such information from employers was begun. The new data are more accurate with respect to both occupation and industry, since they come from plant records rather than reports from someone in a household, but their principal advantage is that they make it possible to analyze occupational composition by size or modernity of plant and by differing specific product or production methods within an industry. Very little of this analysis has yet been done, but if it can be carried on in the future, especially if composition can be related to wage rates, many needed insights may be forthcoming.

Occupational supply in a mobile society with formal entrance requirements in only a few licensed occupations includes all persons who would seek work in the occupation under given wage rates. Workers may be drawn in from among workers in other occupations who have qualifying education and experience; persons outside the labor force, such as housewives; and, of course, students who train for the occupation. Losses from the labor supply resulting from deaths, retirements and other withdrawals from the labor force, and movement to other occupations have to be replaced.

Since the mid-1940s, the Bureau of Labor Statistics (BLS), and more recently state agencies using BLS methods, have estimated only one component of replacements—deaths and retirements. Using age-specific rates for the entire male and female labor force, they developed specific rates for men and women in each occupation from census data on the age composition in the occupation. It was recognized that these estimates included no allowance for shifts to or from other occupations.

Recent research has begun to develop information on occupational mobility (Sommers and Eck 1977; Wash 1977; Eck 1980). The difference in the magnitude of the situation when mobility is included as a factor is illustrated by the fact that the death and retirement rate for professional and technical workers as a group was estimated to average less than 3 percent annually (U.S. Dept. of Labor 1979a, p. 6), while the rate of loss, including out-mobility, was estimated at about 10 percent. When in-mobility is taken into account, the net loss rate is lower. The BLS is still trying to learn how to use these data, and it is continuing its research on mobility and on how workers get training for their occupations.

The need for projections for states and smaller geographic areas arises out of the use of projections for vocational choice as well as for the planning of education and training programs. Such projections were made for many years by state employment security agencies, which surveyed employers to get their views about future demand for occupations. This program was abandoned in 1975 as time consuming, expensive, and insufficiently reliable (Dubinsky 1981). Instead, state agencies used methods developed by the Bureau of Labor Statistics, a major feature of which was the systematic, local collection of data from employers on current employment by occupation. These data were used, together with the BLS national projections of employment by industry, in developing industrial and then occupational employment projections by state and for many substate areas. The methods used were compared with alternative methods, including econometric models and input/output analysis for state economies, in an evaluative study. This study concluded that the present method is generally most effective because of its accuracy, cost, and use of readily available data, although in situations involving less-stable local economies or those that are economically more self-sufficient, better projections could be made by using econometric models (Harvey Goldstein 1980).

Beyond Harvey Goldstein's study, there is little that can be done at present to evaluate the projections made by the state agencies in recent years. Publication of 1980 census occupation statistics for states will make it possible to review earlier projections made using 1970 census-based occupational composition data for industries. Recently, the states have shifted to use of the occupational composition data collected in the U.S. Department of Labor's *Occupation Employment Statistics Survey*, and when data from this source are available for years for which projections have been made, such evaluations will be possible.

The projections now available from government agencies are more copious in detail, more frequently issued, and more complete in geographical coverage than ever before. At a national level, the BLS continues to issue the *Occupational Outlook Handbook* every two years and the series of bulletins entitled *Occupational Projections and Training Data* at approximately similar intervals. The latest of these (Bulletin 2052, dated September 1980) has projections for nearly 240 occupations to 1990. The National Science Foundation projects the demand for Ph.D. scientists and engineers. The latest in the National Science Foundation series was issued in 1979.

States, working in cooperation with the National Occupational Information Coordinating Committee and with technical assistance from BLS, have an extensive projections program. All states and the District of Columbia were producing statewide projections of demands, according to a June 1981 survey (NOICC 1982). In forty-seven states, projections were also made for substate areas, including 199 Standard Metropolitan Statistical Areas (SMSAs) and 359 other areas, such as counties, CETA prime sponsors' areas, planning districts designated by the states, and other labor market areas. Data on the numbers of persons in training for various occupations are compiled by forty-seven states, in thirty-eight at a state level and in thirty-two for substate areas. Altogether, there is some sort of supply data for ninety-six SMSAs and 238 other substate areas. About fourteen to fifteen states project demand to 1990, while the others have made shorter term projections. The projections are revised most commonly at three- to four-year intervals. They are issued in a variety of forms, some very attractively packaged, others fairly technical and intended mainly for use by educational and training officials.

HOW ACCURATE ARE THE PROJECTIONS?

There are two principal purposes for evaluating projections: one is to see how useful they were as a guide to the decisions people made; the second is to find out why errors occurred, in order to improve future projections.

In general, projections should be evaluated by whether they lead to the right or the wrong decisions on the part of those who use them. A criterion of *usefulness*, as distinct from accuracy, has been suggested in evaluating the applicability of projections to a decision. "A forecast has to be judged according to the policy advice to which it leads," says

Cairncross (Ahamad and Blaug 1973, p. 24). A forecast that reduces the uncertainty of a future outcome in such a way as to lead to a unique decision is useful for policy purposes. On the other hand, if the range of uncertainty in the forecast is so large that contradictory policy decisions are compatible with it, then the forecast may be of little use for planning purposes. The illustration given by Ahamad and Blaug (1973) is that of a policy decision to build a new university, which turns on whether an increase in new graduates of more than 20 percent is desired. A forecast that the demand for graduates will increase by between 5 percent and 40 percent is of little use in this decision: all it tells us is that the decision to build may be either right or wrong, which we know already.

This illustration, however, also illustrates another point: if a forecast showed that the demand for graduates would increase by between 15 and 25 percent, it would be equally useless in making this particular decision; yet a forecast with this error range has a fairly respectable degree of accuracy as forecasts go. It just happens that the range straddles the critical decision point for this particular decision. The same forecast could be very useful for other purposes and other decisions; usefulness in making a particular decision is not a fair test of a general purpose forecast.

One of the considerations in evaluating accuracy is the potential loss from a bad forecast. If a forecast of skilled labor requirements to accomplish a major government mission is too low, and inadequate provision is therefore made for training, the mission may fail or fall short of its goals. If the forecast is too high, and too many workers are trained, the mission will be accomplished, but at an unnecessarily high cost in monetary and human terms. An evaluation of the forecast has to take into account the trade-off between the costs of not achieving the mission and the costs of an overestimate.

The effect of forecast errors upon the flow of workers into occupations is another way in which decisions based on forecasts may be evaluated. If students give weight to the forecasts in choosing courses of study, significantly over optimistic or over pessimistic projections should result in at least temporary labor market imbalances, representing either a poor return on private and social investments in training or a cost to employers. This evaluation would require a study of the relation of course enrollments to the government's forecasts, similar in principle to the studies that have been made of the response of enrollments to the current labor market.

Arithmetical errors in the forecasts are easy to measure, but they are not always significant when the decision uses of the forecasts are considered. If employment in an occupation drops by 50 percent when a decline of only 10 percent was projected, we have an arithmetic error gross enough to make even a forecaster blush, but the poor forecast may have led to the same vocational choices for an individual as a better forecast—though not necessarily to the same decisions in planning training programs.

In evaluating forecasts and forecasting methods, we must recognize that a single test does not prove a method is good, since the same method may not perform as well another time. Only if a method or model makes successful forecasts repeatedly can we have confidence in it. The opportunity to test forecasts by comparing them with actual employment for the target year of the forecast does not come frequently enough: although BLS has been making occupational projections since the 1940s and has issued the *Occupational Outlook Handbook* biennially since the mid-1950s, it has been able to make only a few checks of the projections. Appraisals have been published for projections made in 1949 compared to employment in 1960 (Goldstein 1963), 1959 to 1969 (Swerdloff 1969), 1967 to 1975 (Carey 1980), and 1971 to 1980 (Carey and Kasunic 1982). A long series of BLS forecasts for scientists and engineers was reviewed at a seminar convened by the National Science Board (National Science Foundation 1974, pp. 9-50), and the National Science Foundation evaluated its own earlier projections (National Science Foundation 1973). In addition, a university researcher has evaluated the forecasts in the 1961 *Occupational Outlook Handbook* against actual employment changes from 1960 to 1970 (Tyson 1974). Conclusions reached by BLS from a number of evaluation studies are summarized in a paper by Richard Dempsey (1974).

Early on, the only independent estimates of employment by occupation were from the decennial population censuses. More recently, annual averages from the *Current Population Survey* (from the Bureau of the Census, U.S. Department of Commerce) and annual data from the *Occupational Employment Statistics Survey* (from the U.S. Department of Labor) have made more frequent appraisals possible, but the BLS projections themselves, made for ten or so years in advance without intermediate year projections, prevent more frequent evaluations. It is to be hoped that the BLS will modify this practice, not only because five-year projections are more likely to be accurate than longer ones, but also because checking at more frequent intervals makes it possible to correct the longer term projections.

In making these evaluations of earlier forecasts, the actual employment levels in occupations in the target year for the forecasts were used, and differences between the forecasted growth rates and the actual growth rates were treated as the errors of the forecast. But in fact we should not expect the forecast to be the same as the actual level of employment, for several reasons.

First, as we noted in describing the methods by which forecasts are made, we are not trying to tell what will happen in a particular year, but rather to foretell the long-term trend. Picking a single year is necessary only to make all the data on demographic and economic time series trend data come together in a consistent way, and the projection is really focused on a span of years approximately represented by the target year.

In fact, events that we do not attempt to predict—business cycles, wars, and other catastrophes—may make the actual employment in the target year different from the projection. For example, in 1975, when the United States experienced a recession with the highest unemployment since World War II, the total employment was only 27 percent higher than in 1960, while an increase of 33 percent had been projected. In such cases we have to allow for the departure from the long-term trend in evaluating the projections. Other assumptions underlying the economic scenario that frames the projections are equally normative rather than intended to be realistic. Peace is assumed, with implications for the size of the armed forces and the amount of defense production, but there are different kinds of peace and, therefore, of military expenditures and personnel levels, and these important elements of the economic and labor force situation are subject to unpredictable variation. These and other more subtle differences between the actual and the projected economy have to be allowed for in evaluation of the accuracy of the projections.

A second difference between the projected and the actual figures is that the initial projection was in concept closer to human resource requirements under a given set of assumptions and conditions, while the actual level of employment reflects the interaction between demand and supply in the current year. If the supply of trained workers was not produced by the training system, and untrained workers cannot be substituted, employment will be less than projected.

How, then, can we use the actual employment in the target year of a projection to evaluate that projection's accuracy? One approach is to brush aside most of these reasons for difference as self-inflicted liabilities of the method, and accept as valid only the difference between the long-term trend and the effects of short-term factors on employment in a single year. To get a trend value, average employment levels in the occupation for a three-year or a five-year period centered on the target year should be used in preference to single-year data for evaluating the projection. Annual data are now available in the *Current Population Survey* for many occupations, and more precise detail will be coming out of the *Occupational Employment Statistics Survey*. The sampling variability in both these sources would be reduced by averaging them for several years, an additional reason why they are more suitable than a single year's data. The effects on employment of the remaining unpredictable political and natural events that are usually simply assumed away would then show up as errors in the projection, which is what they are anyway from the viewpoint of the projections user. A test of the averaging method for the evaluation of the BLS projections from 1970 to 1980, using—instead of the 1980 actual employment data—an average of the actual data for 1979, 1980, and 1981, showed the latter to be closer to the projection in most cases (closer in twenty-five out of forty-three occupations, further away in sixteen, and the same in two) (Carey and Kasunic 1982; and U.S. Department of Labor January 1980 and January 1982).

While the evaluation method proposed in the previous paragraph might satisfy users, it would not serve the other purpose for evaluating forecasts, which is to give insight into the causes of errors. For this purpose an evaluation has to identify the contribution of each unrealistic assumption to the total error.

In evaluating projections, we should check the accuracy of the estimates of job openings, which include both the annual growth of the occupation and the number of jobs opening up annually because of deaths, retirements, and net occupational shifts. The rate of growth is important in itself: it has a powerful effect on the tone of the labor market. There is a palpable buoyancy in the market for a rapidly growing occupation and a depression in one declining, and these may be reflected in wage rates—all of which makes the rate of growth significant in choosing an occupation. Yet job openings are at least equally important, for replacement is usually larger than annual growth, and jobs can open even in declining occupations—information useful in vocational choice as well as in planning training.

Yet all the evaluations of the accuracy of forecasts have concerned themselves with growth alone. This is because until recently there have been no actual current data on movement of workers into and out of occupations. The recent research on occupational mobility, referred to previously, may make it possible to evaluate this component in the future. At the moment, all we can evaluate is the projected employment.

Evaluations of the projections that have been made by BLS and others take several approaches to measuring their accuracy. One is to see how far the projected *levels* are from the actual levels in the target year. Another is to see how far the projected *rate and direction of change* are from the actual rate and direction of change. It is obvious that the first approach presents the least challenge to the projector and should be judged by the most rigorous standards. It has been justified on the basis that for some of the major purposes for which projections are made it is the job openings that must be estimated, and these are very much affected by the replacements, which are, in turn, affected by the size of the occupation. An evaluation of the accuracy of the projected level thus indirectly evaluates the accuracy of the job openings estimates. Since we have no other way of doing this at present, this is a plausible reason for this approach; nevertheless, the wide variation in mobility rates for different occupations means that the size of the occupation doesn't tell us that much about job openings.

Moreover, there is little that we can learn from the average error in the projection of the occupation size: the BLS evaluation of their projections for 1975 showed an average error of 20.8 percent in the projected employment levels in seventy-six occupations (Carey 1980); the average error for the 1980 projections (sixty-four occupations) was 22.4 percent (Carey and Kasunic 1982). (When the percentage errors are weighted by the size of the occupation, the average in both cases drops to about 14 percent, showing that the projections for large occupations were better than for small ones.) It is not clear intuitively whether errors of this magnitude in predicting the level of employment for ten years ahead represent a good performance of the estimating method or a poor one, and the implications for users are also uncertain. In this chapter, greater attention is given to the accuracy of the projections of change.

Evaluations of the accuracy of projected changes may take several forms. One is to count the number of declines that were correctly predicted. Since the economy is growing, "a rising tide lifts all the boats," and only unusual circumstances result in declines. It is therefore more difficult to identify declining occupations; a prediction that all occupations will grow is likely to be correct in most cases. But from the viewpoint of the uses for forecasts, it is important to identify declines so that steps can be taken to retrain and place workers who are in such occupations and shift emphasis in training away from shrinking fields.

Similarly, the number of very rapidly growing occupations that are successfully identified is a measure of the usefulness of the projections in anticipating supply bottlenecks and occupations requiring special training expansion efforts.

Another and more summary way of looking at accuracy is to count the number and percent of occupations for which the rate of growth is predicted within reasonable bounds of accuracy—that is, whether slowly growing occupations, those growing at an average rate, and fast-growing ones are identified. This determines whether the user can have a reasonable expectation that the individual occupation being considered is likely to be projected correctly.

Before reviewing the accuracy of forecasts, we can gain some perspective by looking at what forecasters are up against: the degree of variability that occurs in occupational employment trends. If growth rates for the various occupations differ from the average within a narrow range, we should expect projections to come close; if they are widely dispersed, we should expect greater difficulty in projecting accurately. The variability is illustrated by the record of actual growth rates of employment in two recent periods shown in table 4-1. This record includes occupations for which employment statistics, based on comparable definitions, are available for both the base year and the target year of the forecasts.

This is a veritable zoo—a wide dispersal of changes within a ten- or fifteen-year period. Only one in five occupations in the first period, and one in seven in the second, increased at an about-average rate. Occupations are highly volatile in their employment and subject to very diverse economic forces. It is clear the decision makers really need guidance; they cannot count on stability and homogeneity in occupational outlooks.

In reviewing the record of the BLS projections' accuracy, we will not go back to the earlier appraisals previously cited; we will concentrate on recent projections, which not only should be better as a

TABLE 4-1
ACTUAL GROWTH RATES OF EMPLOYMENT FOR TWO PERIODS, BY PERCENT

	1960-1975	1970-1980
Average change[a]	28.9	23.7
Total number of occupations compared	76	64
Occupations with:		
Declines in employment	16	20
Increases in employment		
About average[b]	17	9
Below average[c]	11	10
Somewhat above average[d]	11	11
Twice to triple average	11	5
More than triple average	10	9

SOURCES: Carey 1980, p. 15; and Carey and Kasunic 1982, p. 26. Estimates for the terminal years are subject to larger sampling error.

[a] Change in total employment for all occupations.
[b] Within 10 percentage points of the average.
[c] More than 10 percentage points below average.
[d] Between 10 percentage points above average and twice the average.

result of improved data and experience, but are also more relevant to current uses of projections and more indicative of the problems remaining to be tackled.

First, we will look at whether the projections identified the occupations that declined in the face of general economic growth. From 1960 to 1975, sixteen occupations out of seventy-six evaluated by the BLS declined in employment (Carey 1980). Only five of these had been projected to decline; small increases of less than the average had been projected in the other eleven cases (very small increases of *less than half* the average in seven of these). But when the sampling errors in the *Current Population Survey* estimates for 1975 are taken into account, some of these declines become questionable: only seven of the declines were greater than one standard error of the estimates—those in all of the five occupations that had been projected to decline and in two of the occupations that had been projected to have very small increases. The occupations that were projected to decline and that actually declined were knitters and loopers, weavers, compositors and typesetters, postmasters, and locomotive engineers' helpers. Those that were projected to have very small increases but that actually declined were locomotive engineers and machinists. In addition, the occupation of sailors and deckhands, in which a decline had been projected, increased, but by less than one standard error. Taking into account the sampling errors of the 1975 estimates, the projections did fairly well in identifying most of the occupations that clearly declined.

Looking at the same question for the 1970-1980 changes, we find that twenty out of the sixty-four occupations evaluated by BLS recorded declines (Carey and Kasunic 1982). For six of these, declines had been projected; for three more, a very small increase or no change had been projected; for four more, increases of between half the average increase and the average had been projected; and for seven, above-average increases had been projected. If, however, we take only those occupations in which declines clearly occurred—that is, those in which the decrease in employment was greater than the standard error of the 1975 estimate—we have only ten declining occupations. In five of these, the prediction had been a decline or no change in employment; in one (telephone operators), an increase of less than the average rate had been predicted; and in four (airplane mechanics, mail carriers, postal clerks, and credit managers), above-average increases had been predicted. Thus the predictions did fairly well in pinpointing the occupations with decreasing employment, though not as well as in the 1960-1975 forecast.

A second test is whether the occupations that actually grew very rapidly were identified in the forecast. If we take rapid growth to be an increase of more than twice the average, we find there were twenty-one such cases in the 1960-1975 period; eleven of these had been projected to grow by more than twice the average rate, and another seven had been projected to grow at above the average rate but not quite twice as fast. Only three had been projected to grow at less than the average rate.

From 1970 to 1980, fifteen occupations grew by more than twice the average rate. Three of these had been projected to grow this fast; another eight had been projected to grow faster than the average; and only four had been projected to grow by less than the average rate. The projections, therefore, did fairly well in identifying the occupations that needed special attention in planning training programs, and again the earlier set of projections did better than the more recent one.

Taking all the projections together, we can evaluate how close they came to the actual changes in rough terms by using the classification scheme for the direction and extent of change sketched out in table 4-1.

Defining a change of "about average" as one in which the increase was within the range of 10 percent above and below the average for total employment, this scheme goes on to identify below-average, somewhat above-average, between twice and triple the average, and more than triple the average percentage increases, as well as the decreases. If an occupation was projected to grow at a rate within the same interval as it actually grew, we may consider this projection "on target"; if the projection was in an adjacent class interval, it may be considered "close" for the rough purposes for which projections are used. Projections more than one class interval away are counted as "not close." This method of working with grouped data makes some allowance for the sampling errors. The actual comparisons are shown in tables 4-3 and 4-4 at the end of this chapter. The results are summarized in table 4-2.

TABLE 4-2
SUMMARY ANALYSIS: ACCURACY OF PREDICTIONS FOR TWO PERIODS

	1960-1975		1970-1980	
	Number	Percent	Number	Percent
Total occupations	76	100.0	64	100.0
On target	30	39.5	21 [a]	32.8
Close (adjacent class intervals)	30	39.5	17	26.6
Actual increase was higher than projected	11	14.5	11	17.2
Actual increase was lower than projected	19	25.0	6	9.4
Total on target and close	60	78.9	38	59.4
Not close	16	21.1	26	40.6
Actual increase was higher than projected	5	6.6	12	18.7
Actual increase was lower than projected	11	14.5	14	21.9
Summary: direction of errors				
Total, actual increase higher than projected	16	21.1	23	35.9
Total, actual increase lower than projected	30	39.5	20	31.3

SOURCES: Carey 1980 and Carey and Kasunic 1982.

[a] Includes two occupations in which no change was projected and that actually declined.

In the first projection, thirty occupations (about 40 percent) were on target and an additional thirty were close; so in nearly 80 percent of the cases the forecasts were "in the ball park." The second projection's on-target score was not far behind (33 percent), and when the close projections are added to these, about 60 percent of the forecasts were in the ball park.

The direction of the errors may be seen in the summary at the bottom of the table. In the first projection, BLS projected too high in nearly twice as many cases as it projected too low; the effect of the 1975 recession may be seen in this result. In the second projection, the balance between too-low and too-high projections was more even—twenty-three too low and twenty too high. Thus, except for recession periods, the system does not appear to have a bias.

It may be instructive to look at the occupations that were projected much too high and those projected much too low in both periods. Taking only the "not close" cases, where the actual change was more than one category removed from the projected change, we find the following:

Occupations projected too high in both forecasts:

Telephone operators
Mechanical engineers
Inspectors, log and lumber
Patternmakers
Plasterers
Credit managers
Postal clerks
Photoengravers and lithographers
Aeronautical engineers*
Civil engineers*
Chemical engineers*
Fire fighters*
Mail carriers*

Occupations projected too low in both forecasts:

Roofers
Boilermakers
Lawyers*
Cooks*
Jewelers and watchmakers*
Dieticians*
Guards*

We can identify some patterns in these persistent errors. The BLS record for projecting demand for engineers to grow faster than their employment actually grew is documented in an earlier evaluation (National Science Foundation 1974). This was attributed to an overestimate of the growth of research and development expenditures in industry. This is in contrast to BLS's simultaneous projections of demand for scientists, which were much closer to the actual growth. Unlike engineers, a large proportion of scientists are employed in academic institutions, with a more predictable growth.

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*Actual change was only one category off from the projected change in one of the years.

The overprojection for telephone operators reflects failure to take adequate account of the continuing mechanization of the telephone system and greater use of direct dialing.

The continued overprojection of demand for credit managers may reflect insufficient allowance for the increasing use of bank credit cards in retail trade and the decreasing dependence of stores on their own charge account systems.

The effect of increasing use of dry-wall construction on employment of plasterers was not adequately taken into account in the projections for that occupation.

Creation in 1971 of the U.S. Postal Service which was pledged to raise productivity, and growing competition from new private package and express services reduced employment of postal clerks and mail carriers to below predicted levels.

On the other hand, *overestimates* of the effect of new technology in reducing demand for watch repair work may be one of the factors explaining the greater employment growth for jewelers and watchmakers than was projected.

The hazards of forecasting are sharply illustrated in the case of the legal profession. Over the first half of this century, the numbers of lawyers and judges rose at a sedate average rate of 1.1 percent annually. Through the 1950s and the 1960s, the profession grew by an average rate of 2.1 percent (more slowly than did total employment, which grew at a 2.9 percent rate). Those who made the 1960-75 projections had some sense that growth would accelerate, and they projected an average annual growth rate of 2.4 percent for the fifteen years. In making the 1970-1980 projections, they threw caution to the winds and projected a growth rate of 2.9 percent. What actually happened was that in the 1970s employment of lawyers took off like a missile from the launching pad, nearly doubling in ten years, and averaging 6.5 percent growth annually—more than three times the rate of the previous two decades. (Employment estimates for 1980 may have been exaggerated somewhat by the misreporting of paralegals, a new and growing occupation, as lawyers, but the effect of this could not have been large.)

Contributing to this incontenent growth have been government interventions in such fields as environmental protection, employee safety, civil rights, and equal employment opportunity; new legal developments such as the invention of the class-action suit, which multiplies the potential number of plaintiffs and the dollars in damages that may be recovered, thus blowing small cases up into big, lucrative ones; more people having bigger incomes to shelter from taxes; such inventions as the medical malpractice suit; and legal aid and prepaid legal services, bringing the joys of litigation to more people. More than anything else, the legal profession is a prime example of Say's law that supply creates its own demand; the minute a lawyer gets that steely glint in his or her eye, another lawyer's phone rings.

With all this bubbling and boiling of innovation and new sources of legal activity within the profession, the striking and sobering fact is that the BLS projection system, as a system, has no way of formally recognizing this trend. The input/output table of 156 sectors used in the 1990 projections recently released (U.S. Dept. of Labor 1982) has a line for the wooden containers industry, with 25,000 employees in 1979, but none for legal services, an industry of more than 500,000. (Indeed, the table includes about 111 goods-producing sectors and 38 service-producing sectors, although two-thirds of all employment is in services—a cultural lag for which the Commerce Department, which produces the table, shares responsibility.) The only way to anticipate growth in an occupation of this kind is by intensive and sensitive study of developments affecting the profession—the kind of study the BLS staff tries to do, but that is made difficult by the persistent budgetary attrition of the past ten years. Identifying turning points, unless they are signalled by such demographics as the effect of birthrate changes on employment of teachers a decade ahead, is the most difficult task in forecasting.

More generally, the BLS analysis of the sources of errors leads us to conclude that the projections of employment by industry (that is, the industries the BLS system projects) were relatively accurate, but BLS projections of the occupational composition of industries have been a major source of error in the occupational projections (Carey 1980, pp. 17-18). Contributing to the poor projections of occupational composition have been failures to anticipate the effects of technological change on occupations in each industry. Compared to the errors in projecting occupational composition, those errors occurring in projections of the size of the labor force (including a consistent underestimate of the growing participation of women, according to Ryscavage 1979),and those occurring in projections of employment by industry (Personick and Sylvester 1976; Christy and Horowitz 1979) have relatively small ultimate effects on the occupational projections.

In summary, the forecasts we have evaluated have met the tests we gave them moderately well, although with less than complete accuracy. They did fairly well in identifying most of the occupations in which employment declined and did better in identifying occupations with very rapid growth. In 60 to 80 percent of the cases, the actual rate of change was anticipated with ball-park accuracy. In all these tests, the most recent projections did not do as well as in an earlier set, a result that is unsettling, since we should expect improvement with experience and better data.

There was not apparent general bias upwards or downwards in the projections; the effect of a recession in the 1975 target year made some of the projections (which assumed no recessions) too high, but this should not be counted a defect in projections of long-term trends. There was no tendency to overestimate or underestimate the growth of any group of occupations, as was found in the earliest evaluation of the BLS projections from the late 1940s to 1960 (Goldstein 1963), which noted a persistent underprojection of white-collar occupations.

Inability to anticipate the effects of technological change adequately was a frequent source of error. Sometimes the effects were overestimated, but more commonly they were underestimated. Although the method BLS uses gives less information and specific forecasts for the service-producing industries than for the goods-producing industries, most of the occupations with the worst projections were employed predominantly in the goods-producing area.

A general weakness in the methods noted by BLS evaluation studies was the poor projection of occupational composition of industries. New data from the *Occupational Employment Statistics Survey* will make it possible to analyze trends in occupational composition more intensively.

What does this record imply for the utilization of the data in decision making? For the institutional users of many projections, such as educational planners and government program administrators, the record suggests that decisions made on the basis of the projections are more likely to be right than wrong. For the user of an individual occupational projection, some caution seems to be in order, since that particular projection may be one of the minority that are far off the target; nevertheless, this risk does not invalidate their use in occupational choice, since most occupational projections are within a reasonable distance from the target, and consulting these projections is more likely to give sound guidance than the individual's own guess. If there are individuals who are exceptions to this rule, BLS would like to hire them.

A few recommendations for research and data collection to improve the projections are suggested by these findings:

1. Research on the occupational composition of industries should exploit the *Occupational Employment Statistics Survey* data being collected. To understand differences in occupational composition among plants in an industry, it may be necessary to collect information on the industrial processes used, modernity of equipment, and specific raw materials used or products made in each plant. It will also be useful to relate wage data to occupational composition and to study the wage-elasticity of demand for each occupation, which may differ among industries, depending on technology, the amount of capital invested in a particular process, and the numerical importance of the occupation in the plant.

2. The input/output table should be extended to give more detailed information on the service-producing industries, or other methods of projecting demand for services should be developed.

3. Research on occupational and geographic mobility should be continued, and it should be related to the ways in which workers train for each occupation and to relative wage rates. (The planned combined supplement to the *Current Population Survey* on mobility and how workers were trained for their present occupation, scheduled for January 1983, is a major step forward.)

4. Intermediate projections for four- or five-year intervals should be made in the course of making ten-year projections. They are useful in all the usual ways for projections, are likely to be more accurate than ten-year projections, and make it possible to evaluate projections more frequently and revise them as necessary.

5. Rather than a single projection (which no matter how hedged about with qualifications, implies to many users greater precision than is intended), the forecasts should show a range of projections for each occupation reflecting a reasonable set of

alternative assumptions. In this way the user gets some idea of the sensitivity of the projection to alternative economic scenarios and a clearer indication of the degree of accuracy the projections carry. Such projections on three alternative scenarios were made in the latest BLS publication (U.S. Dept. of Labor 1982) and will be embodied in a forthcoming revision of *Occupational Projections and Training Data*.* This has not yet been done by state agencies. In addition, forecasting agencies should consider adding to their publications a statement on the accuracy of the forecasts, possibly based on the evaluations they have made of past experience.

6. The adjustment of local training efforts to the local labor market should be monitored constantly by follow-up studies to learn whether graduates found jobs in the fields for which they were trained and at what wages. This is done carefully in some states, but in others the data are collected from teachers who depend on hearsay rather than from the graduates themselves, and the results are not always taken into account by the officials responsible for planning.

RESPONSIVENESS OF EDUCATIONAL INSTITUTIONS TO PROJECTIONS

The record of responsiveness to the projections and forecasts that have been made for more than thirty years is mixed. The federal government has used projections in formulating and planning new programs. There are many instances in which occupational projections have been used to study the effect of specific federal programs on supply-demand conditions for workers in specific occupations. For example in the mid-1960s, the Bureau of Labor Statistics studied the effects of rapidly rising expenditures for the space program on the demand for scientists and engineers in response to concerns that the space program would utilize so many scientists and engineers that shortages would develop in other sectors of the economy. (There was no published report.) Occupational projections have been used to analyze the ability of the economy to build specified numbers of housing units. Projections of the availability of professional staff to work in community mental health clinics were taken into account in drafting that legislation in the early 1960s.

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*In two-thirds of the occupations,the percent change projected on the highest general economic assumptions differs from that projected on the lowest by less than 10 percent; and in nine-tenths of the occupations, the difference is less than 15 percent. This is a fair degree of robustness for ten-year occupational projections when the average growth for all occupations is from 22 to 31 percent on the two assumptions, but it reflects only the sensitivity of the projections to general economic assumptions; there is room for additional projection error resulting from unanticipated technological or social changes.

Projections are now being developed to identify the impact of an expanded defense budget on occupational employment. These projections will be used to analyze the potential for shortages if specific action is not taken to avoid them. Projections developed by other federal agencies also are used to analyze the effects of specific federal programs on employment or to see if specific programs are needed to achieve desirable goals. For example, the U.S. Department of Health and Human Services has used occupational projections to study the adequacy of health service that could be provided. In 1980, the National Science Foundation developed projections to determine the adequacy of the supply of scientists and engineers to respond to challenges in energy, health, agriculture, and defense (National Science Foundation and Department of Education 1980). The National Science Board's interest in using labor force projections in developing science policy is illustrated by its convening a seminar of experts to evaluate the accuracy of projections (National Science Foundation 1974). The secretary of energy has recently (March 1982) asked the National Petroleum Council "to undertake a comprehensive study that will assess the work force situation for major energy development in the United States in the 1980's." This study will update an earlier report titled *Materials and Manpower Requirements for U.S. Oil and Gas Exploration and Production, 1979-1990*, prepared by the National Petroleum Council (1979).

The policy result of these evaluations has frequently been the institution of fellowship and other student aid programs to encourage enrollments in fields in which more skilled workers were needed.

The responsiveness of vocational education planning to the projections has been a continued source of concern to many, including the Congress. Lack of response earlier has been documented and discussed in a number of studies (e.g., Young, Clive, and Miles 1972; Drewes and Katz 1975). The problems were by no means confined to the vocational education authorities. Among the barriers to the use of projections was the unavailability of forecasts at appropriate geographical levels and in terms that could be related to the curricula with which vocational education planning was concerned. The National

Occupational Information Coordinating Committee was set up by Congress to bring the producers and potential users of labor force projections information together. Under the leadership of NOICC and its associated State Occupational Information Coordinating Committees, a number of steps have been taken. The occupational terminology used in labor market analysis and the curriculum terminology used in vocational education have been brought together by "crosswalks"—in effect, foreign language dictionaries enabling each field to know what the other is talking about. State and local projections have proliferated, as we have noted previously. SOICCs have helped in bringing together information on local training activity in various public and private schools and in human resource development training programs so that a more complete picture of local occupational supply can be developed. As these efforts continue, we can hope that the links between the forecasters and the planners will be strengthened and that information flowing both ways will illuminate the work of each.

While vocational education authorities have to consider future demands for labor in planning, they will probably continue to respond also to student interest in various courses.

Institutions of higher education, many of whose graduates seek employment in nationwide labor markets, are not linked together in any way to ensure that their professional training will meet national needs. They are primarily consumer oriented, trying to be responsive to the course preferences of students. What planning is done at this level is generally confined to the federal government's role in encouraging enrollments in fields related to national programs. From time to time the government, professional associations, or industry organizations call attention to what they consider mismatches between the numbers in training and the employment opportunities in various fields, and the schools may respond individually to such perceptions. (There was greater interest in projections among institutions of higher education—especially state university systems—in the 1950s and 1960s when arguments were needed to persuade legislatures to expand the systems.)

Thus the principal channel by which labor force projections impinge on higher education (except for occasional nudges by government and private organizations) is through students' choices of courses. If a course becomes so popular that facilities and teaching staff are overburdened, there is some indirect (and perhaps unconscious) control in the short run through raising academic standards; if

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overcrowding persists, the institution adjusts in the long run by expanding facilities and staff. The reverse takes place in fields less attractive to students.

Given the value our society places on individual choice, the ultimate channel by which information on future employment prospects affects what training is taken is its use in individual decision making. Educational institutions still need the information to plan their programs so that they can anticipate shifts in student career choices and to give realistic vocational guidance. Government still needs the information to plan its programs realistically and perform its "nudging" function. But attention needs to be focused on the way information is used in decisions by individuals.

I am therefore going to close not with answers but with questions. Are we effectively getting the information to students and young workers? Are they responsive to present efforts—national as well as local, private as well as government? How do they make their decisions? Whom do they consult? What kinds of information do they give weight to? How are appraisals of future employment opportunities—with all their recognized uncertainty—best expressed so that they will be most useful?

At the same time that the producers of projections improve their work and the NOICC/SOICC network continues to bring producers and users together, and at the same time that the schools bring the employment experiences of their graduates, as well as labor force projections, into their planning, someone needs to look at how to do a better job of aiding the decision making of individuals, which is the basic mechanism in our society for adjustment to a changing world.

TABLE 4-3

COMPARISON OF PROJECTED CHANGES WITH ACTUAL CHANGES IN EMPLOYMENT IN SELECTED OCCUPATIONS, 1960-1975

		Actual Changes					
		Decreases	Increases				
Projected Changes	Total		0-18.9%	18.9-38.9%	38.9-57.8%	57.8-86.7%	Over 86.7%
Total	76	16	11	17	11	11	10
Decreases	6	5*	1				
Increases:							
0-18.9%	17	7	4*	4*	1	1	
18.9-38.9%	16	4	2	4*	3	2	1
38.9-57.8%	14		2	7	3*	2	
57.8-86.7%	14		2	2	3	6*	1
Over 86.7%	9				1		8*

SOURCE: Carey 1980, p. 15. The average change (i.e., the change in total employment) in this period was an increase of 28.9 percent.

*Indicates on-target projections.

TABLE 4-4
COMPARISON OF PROJECTED CHANGES WITH ACTUAL CHANGES IN EMPLOYMENT IN SELECTED OCCUPATIONS, 1970-1980

		Actual Changes					
		Decreases	Increases				
Projected Changes	Total		0-13.7%	13.7-33.7%	33.7-47.4%	47.4-71.1%	Over 71.1%
Total	64	20	10	9	11	5	9
Decreases or no change	10	8*	1		1		
Increases:							
0-13.7%	9	1	4*	2		2	
13.7-33.7%	29	8	3	5*	5	2	6
33.7-47.4%	12	3	2	1	4*	1	1
47.4-71.1%	4			1	1		2
Over 71.1%	0						

SOURCE: Carey and Kasunic 1982, p. 26. The average change (i.e., the change in total employment) in this period was an increase of 23.7 percent. On the basis of information provided by the authors, corrections have been made to the published 1980 figures on mail carriers and postal clerks.

*Indicates on-target projections.

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HERRINGTON J. BRYCE

Occupational Forecasting: Reactor Comments

Forecasting is a useful tool for planning future occupational choice, for knowing where shortages or surpluses are likely to develop, for guiding the choices of potential workers, for warning present members of the labor force about the probable future demand for their labor, and for understanding the dynamics of the labor market. The usefulness of this tool, however, depends upon an appreciation of both its strengths and its weaknesses.

Forecasting is as much an art as it is a science. The accuracy of a forecast depends upon judgment as well as methodology. It is theoretically and methodologically possible to evaluate the accuracy of a forecast by adjusting the final outcome for the effects of exogenous or unpredictable occurrences. The methodology for dealing with exogenous shocks is reasonably well developed. But the probability of such occurrences frequently is unknown. Hence, we could conclude that if "X" had not occurred, the forecast would have been on target. Unfortunately, such a conclusion speaks to the quality of the forecasting method more than it speaks to the usefulness of the forecasts, since some form of "X" always occurs in the world, with the probability of such occurrences being higher the more distant the target period.

Consequently, the policy relevance of a long-range occupational forecast lies in its being continuously updated and its being amenable to regular adjustments. It would have been wise for Goldstein to have added criteria of sensitivity and adjustability to his rules for judging the quality of occupational forecasts. Similarly, it would have been useful for him to distinguish sharply between the accuracy of a forecast and the quality of a forecasting methodology. A forecast might be wrong because of unexpected developments, yet the methodology might be perfectly good. The reverse is also true.

FORECASTING AND TRAINING

The problem of judging a forecasting technique is particularly difficult for occupational forecasting, since one of the primary objectives of these forecasts is to influence training and occupational choice. Thus, to the extent that forecasts of occupational requirements are disseminated through the educational and training systems, they feed occupational choices and therefore influence the final outcome.

Most forecasting models and employment data do not adequately distinguish supply from demand components. Even if employment might have grown at the rate implied by the forecasts one cannot estimate the extent to which training institutions might have under- or oversupplied the labor market with persons of specific skills. The result of this under- or oversupplying can produce changes in relative wage rates, unemployment, or underemployment by skill, when downward adjustments of wage rates are not sufficient.

Occupational forecasting is a worthy planning tool to which there is limited subscription. Training and educational institutions have no strong incentives to act in accordance with the forecasts, and none of these institutions can estimate with any accuracy the extent to which a change in the demand or supply of persons by occupation will affect the individual institutions. The forecast might show the growth in occupation "X" to be, say, 15 percent in the next ten years, but what fraction of this market will go to the graduates of each institution? What is the expected market share?

The reluctance to adjust is also affected by the fact that often training for particular occupations requires a large initial investment in buildings and equipment. Once these investments are made, the problem for most institutions is dealing with the variable costs that can often arise; therefore, there is little incentive to shut down. Furthermore, such adjustments as the reduction in variable costs (e.g., the reduction in teacher force) is often sufficient to bring about savings without significantly reducing enrollment, revenues, or the number of graduates, at least in the short run. Indeed, many institutions may see increasing their share of a dwindling demand to be an appropriate response. When many institutions respond this way, the only check is that individual students, knowing the forecasts, would adjust their eagerness to enroll.

Educational institutions are also limited in their range of actions by law. Universal and compulsory education limits the extent to which educational institutions on the secondary level can restrict the supply of labor in particular skills. The more general the educational requirements for entry into the occupation, the more true this point is.

In addition, the "educational institution" is not homogeneous. There are a variety of trainers, including unions, private schools, public institutions, community-based organizations, and employers, engaged in training. Each has a different motive. Unions train and constrain supply; government at one and the same time constrains supply (through licensing and other regulations) while increasing the potential supply through education. These forces are uncoordinated. Because training institutions are highly competitive, individualistic, and numerous, and because they pay no penalty for overproducing and are capable of stimulating their own demand (through advertising), they have very little if any immediate incentive to restrict supply even in the face of falling demand.

In local labor markets, the situation is even worse, since the administrative and political bodies responsible for training and education are separate and distinct from the administrative and political bodies responsible for occupational forecasts and planning. In small jurisdictions, the situation is worsened by the fact that there is no human resource planning at all in some 68 percent of them; and in many jurisdictions there is no linkage between occupational training, human resource planning, and economic development (Bryce 1980, p.2).

FORECASTING AND LOCAL LABOR MARKETS

While Goldstein focused on national projections, Harold Starr and Stephen Franchak focused on local markets. This focus is particularly important because of the current assumptions that local schools should develop linkages with local private employers and that the local private employers should become increasingly involved in training. The motivating assumption is that "they know what is needed." This may be more true about the quality of the skill than about the number of persons who would be needed in each occupation. Experience, as well as the nature of local economic development, tells us that this assumption is wrong (Moser 1971 and Goldstein 1981).

First, some 80 percent of growth in jobs appears to occur in small firms. Such small firms are not likely to have accurate or systematic information about their own future labor requirements, especially if the firms are driven by an expansion objective and if the management, as is often the case, has limited hiring and production experience.

Second, net employment change in a local area is distributed among the expansion, birth, death, and out-migration of firms. Present employers would not have information about the birth of firms. Few would project their own demise. While some may have an idea of their out-migration plans, they will have little if any knowledge of new, incoming firms, and surprisingly few will have any idea of the expansion plans of large firms if the corporate offices of these firms are outside the local labor market.

Thus, how much local employers know is limited. Employer surveys would have to be supplemented by other information. Yet it is surprising how little local governments know about the death of firms or the out-migration of firms other than by inference based on payroll taxes or other data. This is especially true about small firms.

Even if these data obtained from employer surveys were accurate, there are a number of factors that would influence the response of training institutions. In a relatively stable local economy, openings may come mostly through replacements. Such replacement needs can be met through in-migration of workers, promotions, or new hires (the output of the educational institutions). In many instances, this latter option is the least attractive to the employer. Consequently, even though forecasts of labor requirements may show a substantial number of job openings in a particular occupation, such openings may not in actuality be available to the new graduates.

Furthermore, the replacement estimates in local projections do not account for the effects of migration. How much this affects local estimates is uncertain. Net migration rates differ by region, age, and other characteristics of workers including education. In a stable region, net migration may be of limited importance. In a rapidly growing or rapidly declining region, where labor force projections are most significant, it may be of great importance.

It is not certain how any local educational institution should respond to replacement opportunities due to migration; for migration is not only a signal of labor market imbalance, it is a reasonably efficient labor market adjustment mechanism to correct for shortages or excess supply. In addition, the migration streams that would be relevant are those outside of commuting range. The District of Columbia lost 3,000 persons from its labor force between 1979 and 1980. Over two-thirds of these persons were already employed and maintained their jobs in the District, although they changed their residences. No net change in employment opportunities were created (United States Employment Service 1981, p. 21).

The District of Columbia and its metropolitan labor market projections demonstrate a weakness in the linkage between labor market projections and educational institutions. For the three occupations (secretaries, clerks, and janitors) that are projected to create the most openings, only secretaries are trained by educational institutions. All three occupations are ones people might enter without previously defined training. Even where training is required, these are occupations that people enter and leave relatively easily (United States Employment Service 1981, pp. 84-87).

This problem is also reflected in the varying uses of credentials and titles as descriptors of job functions. These differences affect the accuracy of occupational forecasts.

A problem for most local governments as well as local training institutions is that a reasonably accurate forecast of occupational needs within their jurisdictions is beyond them. One method of making local forecasts begins with an estimate of industry requirements, either through single equations for each industry or through shift-share analysis. This latter approach takes into account three components. One component is based on the assumption that the change in each industry will be proportionate to the change in the national economy as a whole. The second component assumes that the growth in each industry in the local area will be equal to its growth in the nation as a whole. The third component, being the shift component, aims to reflect the comparative advantage of the local area. The conversion of these employment levels to the various occupational mixes that correspond to the "typical" staffing may be obtained from local or census data. The results lead to estimates of occupational openings through growth, which, when added to the estimated replacements due to death and retirement, project the total job openings by occupation (Goldstein 1981).

Ironically, the best models for local market forecasts are probably those that permit locality-specific modeling. Data requirements and modeling costs are hardly priorities within local planning budgets.

Given the footlooseness of firms and the mobility of labor, many local planners are likely to focus on expanding labor demand and filling the employment gap through in-migration or commuting rather than through training. Consequently, they will focus on locational incentives for firms to settle within their borders. Frankly, their priorities are in attracting, creating, and protecting existing firms rather than in forecasting occupational requirements. This may be a "Catch-22." Studies of the location decisions of firms show that they place considerable importance on the quality of the local labor force (Schmenner 1981). But local educational planners have little assurance of keeping those they have trained in their locality. For the matchmaking to be successful, the linkage between employment and training has to be contractual and immediate. This is best reflected in arrangements whereby local governments and firms enter into specific training agreements to fill a specific number of jobs as a price for locational incentives including write-downs on land, tax abatements, and industrial revenue bonds.

In conclusion, it seems to me that the fundamental problem we face has less to do with the quality of occupational forecasts than with the mechanisms for translating these forecasts into policy. It has less to do with the forecasts than with the process through which we move toward an equilibrium that is less costly in terms of people investing in the wrong occupations. The problem, to me, lies in the lack of linkage between training jurisdictions (or institutions) and the labor market, and between labor market planners and all others. More basically, the problem lies in the incentive structure of trainers and the fact that there are virtually no penalties for glutting the market with persons trained for a specific occupation.

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6

RICHARD B. FREEMAN
and JOHN A. HANSEN

Forecasting the Changing Market for College-Trained Workers

INTRODUCTION

Over the past decades the job market for college-trained workers has experienced significant swings overall as well as among particular specialities. The once high and rising economic return to college training generally declined in the 1970s, with significant effects on enrollments and degrees. Fields that fared well in the job market in the previous decade did poorly in other periods. Education, for example, was a growth field in the early 1970s and an area of declining degrees beginning in the middle of the decade; physics was a declining area throughout the 1970s, while by contrast business and law experienced sizeable upswings in the period. Engineering, perhaps the most volatile major field, experienced a sizeable market bust in the early 1970s, followed by an explosive boom at the turn of the decade. By 1981 the starting salary offers received by technically trained college graduates exceeded those of their nontechnical counterparts by more than one third. In the companies covered in the Northwestern University Placement Survey, the rate of job offers per graduate in engineering was much higher than for graduates in humanities (Endicott annual series).

In the early 1970s an effort was made to develop small econometric models that would help us understand the labor market dynamics underlying these changes in conditions, particularly the wide swings in student career decisions. At the time the models were estimated, they fit the data quite well and appeared to offer a promising tool for forecasting future changes in the college job market. But how have these dynamic labor market models fared over the course of the 1970s—a decade of extraordinary economic change? Do the models still capture, albeit crudely, the behavior of employers and students in the college marketplace? Are the estimated coefficients of supply and demand responsiveness reasonably stable, given new observations, or do they change greatly? How have the models performed as forecasting tools?

This chapter examines these questions for two important scientific fields, engineering and physics, and well as for overall (male*) college enrollments. The main conclusions of the investigation are—

- The supply-demand analysis embodied in the models continues to capture economic behavior. The experience of the 1970s confirms the responsiveness of students' career decisions to economic incentives and the flexibility of relative earnings to changes in demand and supply in the college market.
- While there are noticeable changes in the magnitude of some of the parameters of the models, in general the coefficients estimated with the additional years of experience tell a similar story of behavior to those estimated in the early 1970s.
- The dynamic labor market model forecasts have proven superior to simple extrapolations of enrollments and degrees, and they have been "on target" more often than not. The most noticeable failure was the inability of the engineering model to predict correctly the magnitude in the boom in enrollments in the late 1970s through the early 1980s.

The chapter is divided into four substantive sections. The first provides a brief review of the structure of the models under study. The second section examines the applicability of the engineering version of the model, focusing on first-year enrollments and salaries. The third section reviews the physics career market, where the dynamic labor market model has performed extremely well in forecasting. The fourth section focuses on the applicability of the model to college enrollments and examines the forecasts of enrollments and salaries made in *The Overeducated American* (Freeman 1976b). A brief conclusion follows.

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*Only male college enrollments were included because of the need for data comparability.

THE LABOR MARKET MODELS

The small labor market models with which we are concerned were originally designed to test and estimate two key aspects of economic behavior implicit in the human capital analysis of the labor and education markets: (1) that the young persons who make human capital investment decisions do, in fact, respond to labor market incentives; (2) that the salaries (lifetime earnings) that are usually viewed as the main incentive change over time as the supply-demand balance changes. The models exploit the fixed time delay between the decision to invest in an occupation and graduation into the job market in order to help identify supply and demand. In addition, the models have recursive structures that can, and apparently do, generate dampened "cobweb" type cycles.*

In their simplest form the models under study can be represented by two equations:

(1) Supply = f [Salaries in field (-1); other supply determinants (-1)]
(2) Demand = f [Salaries in field; demand determinants]

where the (-1) signifies a one-period training lag so that the supply in a given year depends on conditions in the previous year (or on all previous years). As a result of the lag on the supply side, the market is presented with a given number of new specialists. Assuming market clearing, this turns the demand equation into a salary determination equation, with salaries going higher inversely with the size of the graduating class:

(2)' Salary in field = f [Supply; demand determinants]

The basic recursive structure of the system can be seen by either substituting for supply in (2)' or for lagged salaries in (1). The latter yields the cobweb adjustment equation that has been used for forecasting:

(3) Supply = f [Supply (-1); other supply factors (-1); demand factors (-1)]

This equation produces cyclic cobweb behavior in the market, with, for example, heavy demand in year zero generating high salaries, large enrollments, and a consequent large supply in year one, which in turn reduces salaries, causing enrollments to decline. The extent of the cyclic behavior should not, however, be exaggerated: The cycles are almost always highly dampened, so that what makes the models work is the responsiveness to changes in market conditions overall, not the failure of students to have "rational expectations" and foresee and respond to the supply behavior of their peers.

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*An oscillating pattern of shortage and oversupply is called a "cobweb" type cycle, named after the pattern such movements exhibit on a supply and demand chart.

It is also important to note that the model (1) to (3) is an extremely simple version of the types of models examined; in actual work more complex variations have been estimated—for example, with adaptive expectations of salaries built into the supply equation, or with additional equations linking the number of enrollees who eventually graduate to economic conditions during the school years.

Finally, in terms of forecasts, equation (3) offers a relatively direct means of forecasting supplies of new graduates. Given projections of exogeneous demand and supply shift factors, equation (3) easily generates a set of forecasts of supply. The accuracy of the forecasts depends on the fit of the model, the stability of the coefficients of the model, and the accuracy of the projected shift factors.

The following sections describe how well models based on the structure of equations (1) to (3) actually perform in explaining and predicting market behavior.

THE ENGINEERING MARKET

Fluctuations in the market for engineers have long attracted both public and professional attention, and, not surprisingly, engineering was the first specialty to which dynamic labor market models were applied. The Center for Policy Alternatives at MIT (Sirbu et al. 1978) has, in particular, made extensive use of the model in forecasting and analysis of engineering enrollments. This section examines (1) the applicability of the model to the pattern of change in the engineering market in the 1970s through early 1980s, (2) changes in the estimated coefficients of the key forecast equation over the period, and (3) actual forecast performance.

Market Developments

At the heart of the cobweb-type engineering models is the prediction that the markets exhibit certain cyclical characteristics that cause them to oscillate between conditions of excess supply and excess demand. In the case of engineering in the 1970s, this behavior can be demonstrated by a reading of the popular literature on the annual employment prospects for technically oriented graduates. Figure 6-1 reflects a representative sampling of this literature from 1970 to the present. It shows the cycle from "excess" supply (1970-1972) to "excess" demand (1972-1974) followed by a slowdown (1974-1976) and back to excess demand (1977-present). Similarly, the "actual enrollments"—graphed in figure 6-2 show that the cyclical nature of first-year engineering enrollments for the period 1950-1970 continued in the ensuing decade. Periods of rapidly rising enrollments in the early 1950s and 1960s (in response to increasing demands for trained engineers) were followed by sharp downturns in the mid-1950s and late 1960s, and then by a rapid rise in the late 1970s. From these data it appears that in the 1970s, as in earlier decades, the engineering market experienced significant swings in the flow of students into the field.

To see whether the 1970s experience can, as with earlier swings, be explained in terms of the dynamic model sketched in the first section of the paper we have applied the equations of the model to the enrollment and demand for the period 1949-1981. The results, given in table 6-1, show that the observed swings in enrollments and in engineering starting salaries appear to reflect shifts in supply and demand in the posited manner. In these analyses the supply shift variable is the wages and salaries of professional, technical, and kindred workers; the demand shift variables are the Federal Reserve Board index of durable goods production (U.S. Department of Commerce 1981) and the National Science Foundation's research and development expenditure series (U.S. National Science Foundation annual series). All of the dollar series are deflated by the consumer price index.

The first equation in table 6-1 represents the simplest lag structure for the supply equation; expected salaries upon graduation are equal to current salaries. All of the coefficients have the expected signs and are significant, with elasticities of response of about four, but serial correlation is clearly evident. The second equation adjusts for serial correlation and presents a much better fit, with lower but a still sizeable elasticities of response. The third equation presents a more complex lag structure; in this equation the coefficient on salaries falls greatly, while the lagged terms dominate the regression. In solving the system for the long-run impacts of salaries, however, we obtain elasticities comparable to those in the second equation: a response to engineering salaries of 2.59 and to alternative salaries of -1.52.

Year	Article Title	Source
1970	"Unemployed Engineers"	*Engineering News-Record,* December 10, 1970
1971	"Brains on the Shelf"	*Nation's Business,* May 1971
1972	"Engineer Shortage Possible by 1975"	*Industrial Week,* May 1972
1973	"Comeback of the Engineers"	*Dun's Review,* July 1973
1974	"Needed: More Engineers"	*Chemical Week,* March 13, 1974
1975	"Jobs for Engineering Grads Decline 20%"	*Engineering News-Record,* June 5, 1975
1976	"Engineers Find Job Hunting Tough"	*Engineering News-Record,* January 8, 1976
1977	"Engineering: A Well Paid Start, an Uncertain Future"	*Money,* January 1977
1978	"Demand for Qualified Engineers Intensifies"	*Design News,* April 17, 1978
1979	"Job Outlook Is Rosy for Engineering Grads"	*Chemical & Engineering News,* January 1, 1979
1980	"Engineering Shortage Seen as Energy Push Blooms"	*Engineering News-Record,* October 2, 1980
1981	"Engineering Crunch Seen Tightening"	*Engineering News-Record,* April 30, 1981

Figure 6-1. A representative sampling of popular literature on annual employment prospects for technically oriented graduates

On the demand side, the level of engineering salaries is hypothesized to be a function of the size of the previous year's graduating class plus two exogenous demand variables: (1) national expenditures on research and development (available from the National Science Foundation) and (2) the Federal Reserve Board's index of

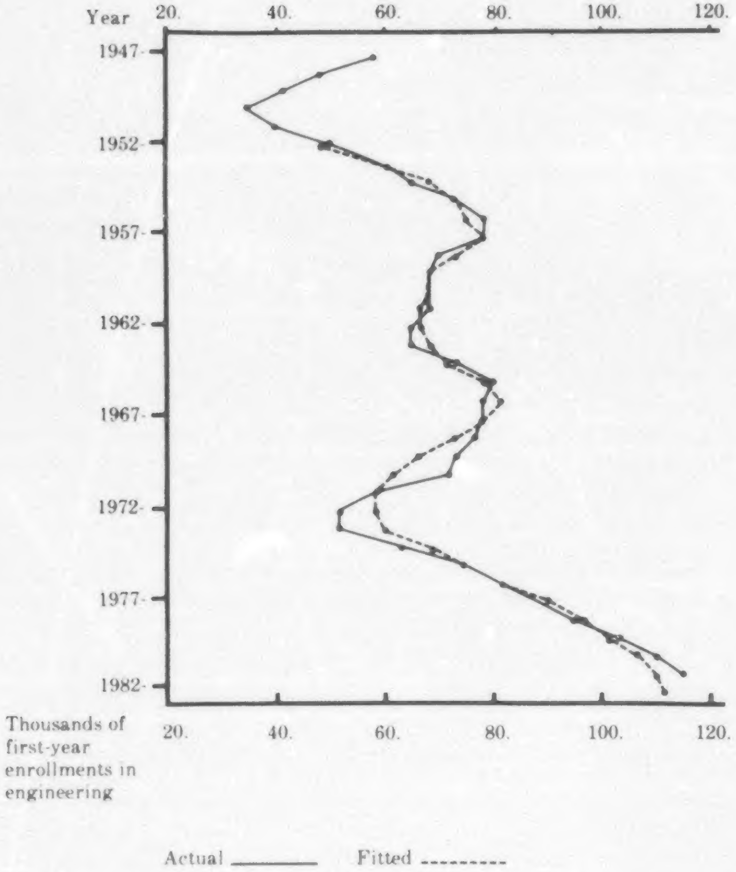

Figure 6-2. First-year engineering enrollment, actual versus fitted, 1949-1981

durable goods production. The results of the regression are reported in the fourth line. Again, the fit is good, with all coefficients significant and having the expected signs. Changes in research and development engineering labor markets. Engineering demand, it seems, experiences a cycle of its own that is more directly related to factors such as the national financial commitment to defense and space and industrial

TABLE 6-1

REGRESSION COEFFICIENTS FOR THE BASIC MODEL ESTIMATED FROM ANNUAL OBSERVATIONS FOR 1949-1981

Panel A The Supply Equation of Enrollments

Eq.No.	Methods	Const	SAL	ASAL	ENR(-1)	ENR(-2)	RSQ	SEE	DW
1	OLS	16.99	4.46 (.84)	-3.85 (.90)	—	—	.64	.17	.47
2	CORC	10.31	2.30 (.81)	-1.54 (.67)	—	—	.88	.09	RHO=.91 (.07)
3	OLS	3.16	0.55 (.60)	0.41 (.58)	1.44 (.15)	-0.71 (.13)	.92	.08	1.79

Panel B The Demand Equation, 1949-1981

	Methods	Const	RD	DUR	GRAD	GRAD(-1)	RSQ	SEE	DW
4	OLS	3.82	.32 (.02)	.07 (.04)	-.08 (.03)	—	.98	.032	.54
5	CORC	3.88	.35 (.04)	.08 (.04)	-.12 (.04)	—	.99	.021	RHO=.69 (.10)
6	OLS	4.08	.30 (.02)	.11 (.04)	—	-.11 (.03)	.98	.030	.52

NOTE: Numbers in parentheses are standard errors. *All* variables are in log form.

KEY: OLS = Ordinary Least Squares
CORC = Cochran-Orcutt Adjustment for Serial Correlation
SAL = Engineering salaries in constant 1967 dollars
ASAL = Professional wages and salaries in constant 1967 dollars
ENR(-1) = Enrollments of engineers, lagged one year
ENR(-2) = Enrollments of engineers, lagged two years
RSQ = R Squared
RD = Research and development in constant 1967 dollars
SEE = Standard error of the equation
DW = Durbin-Watson statistic
DUR = Federal Reserve Board durable goods index
GRAD = Number of engineering graduates

spending have a very substantial impact on the salaries for engineers, whereas the durable goods index also has a significant effect. This observation is consistent with the conventional wisdom about firms' commitments to research than it is related to the business cycle. This conclusion must be tentative, however, since research and development spending and the durable goods index are themselves significantly correlated. The number of baccalaureate graduates has the predicted negative effect on salaries in all specifications.

Finally, we estimate the "reduced form" of the third equation that, in the case at hand, relates enrollments to graduates, research and development, durable goods, professional salaries, and lagged enrollments to represent the structure of expectations about future salaries. For purposes of forecasting, this is the critical equation of the model. Table 6-2 reports the regression results for this model specification over three periods of time, 1949-1972, 1949-1976, and 1949-1981. We have chosen the 1972 to 1976 break periods because forecasts were made using the model specification through those years in previous work (Freeman 1976a; Sirbu et al. 1978). In each period the model tracks the pattern of fluctuations quite well, as is evident in figure 6-2. While the coefficients of the model are reasonably comparable across the years, there are some noticeable changes, particularly after 1976, that reflect the sharp upswing in enrollments in the period; in particular, there is an increase in the estimated impact of alternative salaries. This may reflect (1) the striking decline in real professional salaries (and in college graduates, salaries in general outside engineering) in the period; (2) an "experiment" in variation in alternatives unlike anything in previous decades; (3) an increase in the durable goods index coefficient; (4) a decline in the graduates coefficient; and (5) changes in the recursive structure of the enrnollment figures. If there is a message to be read into the change in coefficients, it is the estimated greater responsiveness of engineering enrollments to the overall college market as opposed to its own cyclic pattern. Behaviorally, this may reflect the fact that for the first time in post-World War II years, the general college job market experienced a major downturn.

Forecasts

Forecasts of the engineering job market using variants of the reduced form "cobweb" equation were made using a model fit through 1972 by Freeman (1975a) and a model fit through 1976 by Sirbu et al.* (1978). These forecasts appear in table 6-3. The 1972 forecasts predicted an upswing in the enrollments after 1973 and continuing through 1976-1977, followed by a decline. The 1976 forecasts predicted a turnaround in the market in 1977-1978, followed by a more gradual downturn. In fact, enrollments did rise from 1972 to 1976, as forecasted; by contrast,

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*In these forecasts we replaced the GRAD term in the reduced form equation with enrollments lagged five years in order to keep the forecast exercise strictly in enrollment units. We fit models beginning in 1952.

TABLE 6-2

REGRESSION ESTIMATES OF REDUCED FORM EQUATION, 1949-1981

Eq. No.	Const.	GRAD	RD	DUR	ASAL	ENR(-1)	ENR(-2)	RSQ	SEE	DW	Period
1	13.24	-.21 (.07)	.32 (.09)	.44 (.09)	-1.37 (.28)	1.01 (.13)	-.36 (.14)	.966	.079	2.34	1949-81
2	12.34	-.27 (.08)	.32 (.10)	.27 (.15)	-.96 (.40)	.92 (.15)	-.40 (.15)	.948	.058	2.10	1949-76
3	11.83	-.40 (.10)	.28 (.09)	.15 (.16)	-.64 (.41)	.67 (.19)	-.14 (.18)	.959	.055	1.94	1949-72

NOTE: Numbers in parentheses are standard errors. Ordinary least squares was the method of analysis used.

For definitions of variables see the key in table 6-1.

TABLE 6-3

COMPARISON OF PROJECTED AND ACTUAL GROWTH OF ENGINEERING MODEL EXOGENOUS VARIABLES BY TIME PERIOD

	Time Period			
	1972-1981		1976-1981	
Indicators	Actual (percent)	Projected (percent)	Actual (percent)	Projected (percent)
Real professional earnings	-1.5[a]	2.8	-1.3	1.8
Durable goods output	2.5	4.1	3.1	4.0
Real research & development spending	1.2	3.7	2.1	4.0

[a] Compound annual growth of indicator

extrapolative forecasts of enrollments predicted continued decline in enrollments. However, the model also forecasted a turnaround in 1978-1979, which did not occur; rather, there was a continued increase in enrollments.

What explains the failure of the model to forecast the continued rise in enrollments at the turn of the decade? One blatant reason for the failure to forecast the continued growth of enrollments at the end of the decade can be seen by comparing the postulated and actual growth of the exogeneous variable over the periods.

Obviously, one reason for the divergence between predicted and actual salaries is that the forecasts postulated continued expansion of the economy—particularly in nonengineering alternatives—which did not, in fact, occur. A second related factor is, of course, the noticeable increase in the coefficient on the alternative income terms (and changes in other coefficients) in the model that includes the most recent period.

To see the relative importance of the incorrect projections of exogeneous variables and the estimated changes in parameters in the forecast error, we have simulated the model estimated for 1949-1976 and through 1981, and have decomposed the error into three parts: (1) error due to incorrect projection of exogeneous variables, (2) error due to change in coefficients, and (3) error due to the interaction of the other two errors. The decomposition was performed using the following formula:

$$a_1X_1 - a_oX_o = a_o(X_1 - X_o) + X_o(a_1 - a_o) + (X_1 - X_o)(a_1 - a_o)$$

where a_o is the coefficient vector from the 1976 model

X_o are the forecasted exogenous variables

a_1 is the coefficient from the 1981 model

X_1 is the true exogenous variable

Such an analysis yields the following result:

Error in 1976 forecast for 1981	44,189
Error due to "incorrect" (change in) coefficients	10,965
Error due to incorrect exogenous forecasts	11,455
Error due to interactions	21,769

Stated differently, about one quarter of the error is traceable to changes in coefficients, one quarter to incorrect projection of exogeneous variables, and *one half to the interaction of the two*. What is striking in this decomposition is the importance of the interaction term which in many such decompositions is quite small. In the period under study, exogenous factors—such as alternative salaries, which diverged greatly from projected values—also had bigger effects than in previous decades. Had the exogenous forecasts been on target so that there was no interaction effect, the model would have forecasted enrollments of 104,215 in 1981, giving a modest 9.5 percent error: had the coefficients been unchanged, a similarly "good" result would have occurred. It is the interaction of the two factors that underlies the failure to forecast properly the 1978-1981 rise in enrollments.

FORECASTS OF PHYSICS

Few academic fields experienced as significant a collapse in the late 1960s through the early 1970s as did physics. After increasing rapidly in the 1950s and early 1960s, federal support of physics research levelled off, then fell relative to other expenditures, reducing the demand at a time when the supply of new physicists was expanding greatly as a result of the preceding boom. With new physics Ph.D.'s unable to get jobs, there was considerable flak in the scientific community, with numerous symposia and much commentary on the problem.

Analysis of the physics job market for the period 1948 through 1973 was performed at MIT's Center for Policy Alternatives and later published in the *American Economic Review* (Freeman 1975b). The analysis suggested that developments in the physics market were reasonably well described by our basic labor market model. In the model the time delay in supply due to the period of training provided identification of supply and demand as well as cobweb-type fluctuations in market conditions. As part of the 1948-1973 analysis, a set of forecasts of Ph.D. supply was made and contrasted to those from three alternative sources, which used basic trend analyses.

The equations used for the forecast are summarized in table 6-4, which gives the results of two models, one focused on Ph.D. degrees and salaries and the other on first-year graduate enrollments and salaries. As can be seen, the equations fit the data well; the supply equations show significant elasticities of response to salaries, whereas the demand equations accorded the degree variable—in this case lagged two years—a negative effect comparable to that found between engineering degrees and salaries.

How do the labor market forecasts compare to the trend forecasts and to actuality? Table 6-5 presents data that give a striking answer to this question. It shows *remarkable accuracy in the labor market model forecasts of developments in physics*, in contrast to inaccurate trend projection forecasts.

The first column gives the number of Ph.D.'s granted in physics, scaled as in the original (1948-1973 fitted) forecasts at 1500 in 1969-1970 that are due to the differing numbers reported by the National Research Council (1981) and by the Office of Education (various editions). The second column adjusts these figures to take into account the late 1970s' increase in the number of foreign students receiving physics Ph.D.'s. As the behavior of foreign students is presumably not dependent on the U.S. labor market, the "adjusted for foreign student"

TABLE 6-4

REGRESSION EQUATIONS USED IN PHYSICS FORECASTS

Model A

Dependent Variable	Constant	Physics Salaries	Professional Earnings	Lagged Number	RSQ	SEE
Ph.D. Degrees, 1956, 1959-1972	-.68	.82	-.42	.83	.99	.03
		(.25)	(.38)	(.11)		

Dependent Variable	Constant	Research & Development (lagged 2 years)	Degrees (lagged 2 years)	RSQ	SEE
Ph.D. Salaries, 1951-1972	3.57	.44	-.14	.96	.037
		(.04)	(.04)		

Model B

Dependent Variable	Constant	Physics Salaries	Professional Earnings	Lagged Number	RSQ	SEE
First-year graduate students, 1954, 1960-1972	8.06	.87	-1.04	.42	.81	.06
		(.60)	(.30)	(.38)		

Dependent Variable	Constant	Research & Development (lagged 2 years)	Degrees (lagged 2 years)	RSQ	SEE
Ph.D. Salaries, 1951-1972	3.57	.44	-.14	.96	.037
		(.04)	(.04)		

SOURCE: Freeman 1975b: Table 4, line 6; Table 6, line 5; Table 4, line 3

NOTE: Standard errors in parentheses.

The first column gives the number of Ph.D.'s granted in physics, scaled as in the original (1948-1973 fitted) forecasts at 1500 in 1969-1970 that are due to the differing numbers reported by the National Research Council (1981) and by the Office of Education (various editions). The second column adjusts these figures to take into account the late 1970s' increase in the number of foreign students receiving physics Ph.D.'s. As the behavior of foreign students is presumably not dependent on the U.S. labor market, the "adjusted for foreign student" figure gives the number of Ph.D.'s that would have been granted had there been no such increase, and provides a more accurate measure of the change in supply induced by U.S. market conditions.

The third and fourth columns record the published forecasts of physics Ph.D.'s based on the equations given in table 6-4. Variant A employed the supply of Ph.D. degrees equation and the Ph.D. salary equation to generate forecasts. Since the number of degrees was based on salary expectations that lagged by four years, predicted salaries were not needed until the 1977 degree forecast. Variant B replaced the degree equation with an equation determining first-year enrollments, thereby assuming a similar percentage increase in Ph.D.'s as in initial enrollments. In both models, research and development was assumed to increase at the postwar rate of growth of real GNP (3.7 percent), so that the research and development to GNP ratio was fixed. Professional earnings were postulated to increase at their postwar trend level of 2.8 percent per year. The remaining columns of the table present the competing trend forecasts.

TABLE 6-5
Ph.D.'s GRANTED IN PHYSICS

	Actual	Actual: Adjusted for Foreign Students	Supply Response Model		Trend Forecasts		
			A	B	Office of Education	Cartter	NAS-NRC
1969-1970	1500	1500	1500	1500	1500	1500	1500
1974-1975	1133	1133	1134	1189	2153	1853	2153
1979-1980	885	843	731	786	2492	2654	3350

SOURCE: R. Freeman (1975b). Actual from American Institute of Physics; adjusted for increases in foreign students from 18 percent of physics Ph.D.'s in 1970 to 1975 to 25 percent by 1980, as reported in National Research Council data (1981).

What stands out in table 6-5 is the striking accuracy of the forecast based on labor market responsiveness compared to the trend forecasts. In the case of physics, forecasts based on economic responsiveness have predicted the decline in Ph.D.'s granted in physics to within 10 percent of the actual number granted, after allowances for increased numbers of foreign students. By contrast, trends forecasts have been far off the mark.

There are two reasons why the recursive market model forecasts of physics have performed better than the extrapolative forecasts and why they have achieved such remarkable accuracy. First, unlike the extrapolative forecasts, the recursive model exploited the *behavioral* responses of individuals to changing market conditions *at a period of time when the market was undergoing significant change.* If the behavioral responses were modest, or if the market for physicists had not been changing greatly at the outset of the 1970s, the forecasts based on the estimated behavior would not have been much better than the trend forecasts. As the coefficients of responsivness in table 6-4 show, however, in physics as elsewhere, students are responsive to economic incentives, and salary incentives change with market conditions.

Second, the recursive model also exploited the most recent information on changing supplies—first-year enrollments—that provide a reasonable indication of future degrees in a field. Had the three extrapolative forecasts used enrollments as well as trends in degrees, they would have given a more accurate picture as well.

Why have the physics forecasts done better in predicting 1980 figures than the engineering forecasts did over essentially the same period? One important reason is that the physics analysis focused on *degrees* rather than on enrollments. Because degrees lagged behind enrollment by four to five years, the physics forecasts did *not,* in fact, peer into the future to the extent that the engineering forecasts did. A more valid comparison would be to contrast the 1980 physics degree forecasts with the 1972-1976 engineering enrollment forecasts, as the 1980 degrees resulted from 1975-1976 supply decisions. In this case, both forecasts look quite good. By standard forecast analyses, one would expect greater errors as the effective time period for the forecasts grows.

COLLEGE GRADUATES

In addition to analyzing and forecasting the market for specific college-level specialties, efforts have been made to apply the labor market models to college enrollments overall. *The Overeducated American* (Freeman 1976b) presented such a model designed to evaluate the declining returns to college education and to forecast developments from 1973 (the last year of data covered in the model) through the end of the 1980s.

How well does the responsive labor market behavior hold up for all graduates? How do these forecasts look in retrospect?

Behavior

A basic behavioral proposition is that students enroll in college for the purpose of investing in human capital and are thus responsive to market conditions. Whereas this proposition was initially controversial to educationists, it has received considerable support in the post-1976 period. Several economic studies using different model specifications have found significant response elasticities: The most recent studies have related male enrollments to rates of return estimated from Current Population Survey data for 1958-1979, and have found elasticities on the order of 0.86 to 1.43 (Mattila 1982).

To see how *The Overeducated American* model and forecasts have fared in the 1970s, we have updated (with two amendments) the regression model presented in the appensix to that book. The first change has been that instead of using input coefficient indices of the relative demand for college graduates, we have simply used a time trend to reflect the slow increase in the demand for college relative to high school workers; the second change is that we have used the number of eighteen- to nineteen-year-old males enrolled in college as the dummy variable rather than the number of first-degree credit-enrolled males, as the latter series was discontinued after 1975.

Table 6-6 presents the results for the three equation forecast models estimated through 1973 (as in the book) and through 1980. The updated equations fit the data well and give a picture of market responsiveness similar to that of the earlier equations. The biggest change is in the enrollment equation, where the coefficient on the relative salary term falls, while that on the lagged enrollment rises. The long-run elasticities

TABLE 6-6

ESTIMATES OF FORECAST MODEL FOR COLLEGE ENROLLMENTS AND SALARIES, 1951-1981 VERSUS 1951-1973

1. **Supply of Freshman Males to College: 1951-1973**

$$FYR = -4.46 + \underset{(.16)}{1.36}\,POP + \underset{(.23)}{1.91}\,[CSAL\text{-}ASAL] + \underset{(.10)}{.05}\,FYR\,(-1) \qquad R^2 = .992$$

1951-1980

$$FYR = -3.80 + \underset{(.15)}{1.20}\,POP + \underset{(.22)}{1.82}\,[CSAL\text{-}ASAL] + \underset{(.10)}{.13}\,FYR\,(-1) \qquad R^2 = .990$$

2. **Dependence of Graduates on Number of Freshmen: 1954-1973**

$$BA = .56 + \underset{(.17)}{.52}\,FYR\,[-4] + \underset{(.18)}{.26}\,FYR\,[-5] \qquad R^2 = .976$$

1954-1980

$$BA = .46 + \underset{(.14)}{.47}\,FRSH\,(-4) + \underset{(.14)}{.33}\,FRSH\,(-5) \qquad R^2 = .967$$

3. **Determination of College Salaries: 1951-1973**

$$CSAL = .47 - \underset{(.05)}{.13}BA(-1) + \underset{(.01)}{.006}TIME + \underset{(.52)}{.48}ASAL + \underset{(.11)}{.56}CSAL\,(-1) \qquad R^2 = .993$$

1951-1980

$$CSAL = -.81 - \underset{(.02)}{.12}BA(-1) - \underset{(.002)}{.001}TIME + \underset{(.17)}{.60}ASAL + \underset{(.09)}{.65}SAL(-1) \qquad R^2 = .990$$

NOTE: Where POP = number of eighteen- to nineteen-year-old men, as reported in *Current Population Reports* (U.S. Bureau of the Census, various editions).

Where FYR = a weighted average of college starting salaries, as reported in "Trends in Employment of College and University Graduates in Business and Industry" (F. Endicott).

Where BA = number of male bachelor's graduates, as reported in *Earned Degrees Conferred* (U.S. Office of Education, various editions).

Where ASAL = average annual earnings of full-time workers in the U.S. as reported in *Survey of Current Business* (U.S. Department of Commerce, annual July edition).

of response implicit in the model, however, are nearly the same: from 1.66 (early model) to 1.61 (later model). In the salary equation, the key coefficient on degrees is quite stable, while the major change is that the time trend falls in significance.

The model in *The Overeducated American* was presented as a crude but easy-to-calculate forecasting model. More complex analyses of the enrollment decision itself were given in other papers (see Freeman 1975a), and thus it is as a forecasting equation that we should judge the model.

In terms of forecasting, the 1973 model of male college enrollments appears to have done a good job in pinning down ensuing patterns of enrollment by predicting a rough stability in the ratio of first-year male enrollees to eighteen- to nineteen-year-old men; our reanalysis using the first-year freshman series yields a similar result. In fact, from 1973 to 1981, the proportion of men enrolling in college dropped modestly, well within the range of prediction of the model. However, the most interesting prediction of the model—that of an increase in enrollments ratio, as well as in salaries in the mid to late 1980s—cannot be examined at this time.

CONCLUSION

This chapter has examined a set of labor market models first estimated in the early 1970s in terms of their behavioral validity and forecasting ability. With respect to the behavior on which the models were built—responsive supply behavior by students and flexible salary determination in the college job market—the experience of the 1970s appears to be largely supportive: Updated variants of the models work well, and new, different specifications show responsive behavior as well.

With respect to forecasts, there is a more mixed picture, with some successes (engineering, 1972-1976 forecast of the turning point and upswing; physics degrees; and male college enrollments) but also failures (notably the post-1976 engineering forecasts). We have examined the forecast models to determine the reasons for problems. One reason has been the inaccurate projection of the exogeneous variable values. In many cases the exogeneous variables were projected rather cursorily; this resulted in substantial divergencies from their actual paths. It is important to recognize that even a "perfect" fitting model can fail to forecast accurately in the absence of good projections of exogeneous variables.

Another problem has been that some of the coefficients of responsiveness changed in the period. In engineering, in particular, there was an increased responsiveness to nonengineering salaries, which attracted more persons to the field than was predicted. The greater responsiveness may reflect the unique "experiment" of the 1970s, in which the real pay of many college graduates outside of engineering actually fell very sharply. The changes in coefficients suggest the importance of annual updating, monitoring, and improving of various models. There is no doubt that the models ignore certain data and variables, which may not be useful in one period of time but may be useful in others.

The analysis of the problems in forecasting engineering enrollments in the late 1970s and early 1980s does not mean that the models are not useful tools in analysis. They do, for example, perform better than trend extrapolations. Furthermore, as noted earlier, they have done well in other markets. Still, forecasts with the behavioral labor market models, while an improvement over crude trend analyses, are no fortune-teller's window to the future. More useful, perhaps, than the forecasts themselves are the behaviors to which the models direct attention.

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7

SAR A. LEVITAN

Occupational Projections: Reactor Comments

INTRODUCTION

Vocational educators frequently are accused of having a narrow perspective, but this instructive conference—fashioned by Bob Taylor, Frank Pratzner, and Howard Rosen—extends the horizons of vocational education to include a Ph.D. in physics. I think that is as high as we should expand the reach of vocational education.

Returning to occupational projections, the subject of this chapter, I believe that computer models are not about to satisfy vocational educators' need for sound labor market and economic forecasting concerning employer demands and the supply of potential vocational education students. It would, therefore, not be wise to let computer models serve as the primary source of information, analysis, and planning. The role of computer models in occupational planning remains marginal given the current state of the econometric art. This is true even for the best computer models, such as the one presented by Richard Freeman and John Hansen at this Forum.

Next, there is the pragmatic issue of what vocational educators need and can realistically expect in the process of planning courses, staffing, and investing in plants and equipment. Lastly, given an era of tight budgets, vocational educators should be asking: How much forecasting do we really need and for what purpose is the exercise being undertaken?

THE FREEMAN-HANSEN MODEL

The Freeman-Hansen model indicates what even the best of minds can produce when playing with computers. The authors of the model claim it to be right two out of three times, but in several instances the model failed to predict major shifts in trends. The key questions we need to be asking are: Does this computer model provide new insights, and can it help in the actual planning process?

This model has several features that are highly laudable. First, while Freeman and Hansen claim to have focused on the supply side, their model does consider demand forces that play a role in the determination of wage and employment levels. Alfred Marshall was right in pointing out that demand and supply are like two blades of a scissors. For the scissors to work and cut, we need both blades. Recent economic analysis has led us down blind paths when it has considered only one side of the market.

Second, the model is laudable because it is quite simple and contains only three equations that attempt to capture basic behavior patterns. As the data processing abilities of computers have grown and their costs declined, there has been a tendency on the part of many econometricians to build highly convoluted models. The law of diminishing returns applies to the art of economic model building just as it does to other endeavors. The Freeman-Hansen model wisely avoids overextension, and it is highly doubtful whether the authors would have improved the model by adding more equations.

The authors base their predictions on a so-called cobweb cycle model, but their arachnology—the model's results look like a spider's web—can be translated into simple English. People not only work for the love of an occupation, but they also labor for gold—even if it be the inflated paper money of this era. Individuals also tend to go into occupations in which they expect to find employment opportunities. While people do respond to market signals, they do so with a significant lag in time.

Specifically, Freeman and Hansen assume that current college students will make their career choices in, say, 1982 based on current information concerning relative wages and employment opportunities. If the relative wage for engineers is high and employment opportunities are promising, then a relatively large number of students will decide to major in engineering. These behavioral patterns follow the standard assumptions of human capital theory, and tend to view the educational process as similar in many ways to investing in stocks, bonds, or money market funds. The student, like the investor, will put off current consumption in the hopes of obtaining greater rewards in the future. If the expected rewards become higher, then all other things being equal, more students will seek education and employment in these fields.

The problem is that these decisions, based on 1982 information, may not be the reality in, say, 1986, when this class of college-trained engineers enters the labor market. Freeman and Hansen assume market clearing, or that relative wages will adjust so that supply will equal demand, an assumption that is hardly backed up by recent market operations. In fact, the authors cite reports that range from a 1971 article headlined "Brains on the Shelf" to a 1981 analysis that reported "Engineering Crunch Seen Tightening." These reports provide evidence that indicates that labor markets are not always in balance and can experience periods of major unemployment or job vacancies. But if market clearing is assumed, the econometrics are easier to deal with. In the short run the supply more or less determines how many new college-trained workers will be in the job market, and the demand determines pay levels.

The lag in the supply response to shifting market forces produces time series for salaries and employment levels that look like a spider's web. The Freeman-Hansen model captures both the human capital response to market signals and the fact that the adjustment can be a long and bumpy process. It also captures other important features of the labor market. The cobweb cycles are caused by both external forces and internal factors. According to this model, even if all the external forces (e.g., the level of federal funding and support for research and development, military spending, corporate profits, productivity, level of gross national product, oil prices, inflation, and public support for higher education) were stable, then the internal factors (i.e., the lag supply response) would be enough to generate some cyclical developments within these labor markets.

However, more important than these internal factors are the major external forces. To borrow the dog race model, supply, like the dog, will follow the mechanical rabbit (i.e., demand) around the track. But by using just the Freeman-Hansen model (or other, similar types of computer models), we have no way of knowing how fast the mechanical rabbit will be moving—or if it will even be going in the right direction. As the authors note, a major failing of their model is that it did not forecast several major changes in the engineering market.

Even the authors, like the best model builders, are often wrong in forecasting the status of the key external factors that influence the results in these labor markets. The authors have concluded the error in projecting the engineering market was due to incorrect values for external variables. Additionally, mistakes were caused because the estimated internal response to market forces was not perfect. The interaction of these two types of errors compounded the total error of the estimates. The swing of actual data often was larger than the "fitted" pattern produced by the model. The model often understated the actual swings within these markets.

Despite these significant errors, the Freeman-Hansen model, which incorporates year-by-year reactions to market signals, is more reliable than simple trend extrapolations. But the same results could be obtained by back-of-an-envelope analysis without the benefits of computers. If one must make forecasts, then one should do them often and always update the results because the external forces have a way of shifting in a manner one often does not fully expect. Also, the internal response has a way of altering.

But some labor markets, due to institutional and economic factors, may be easier to forecast than others even given the shifting sands previously noted. A physics Ph.D. candidate makes a substantial investment in terms of time, dollars, and future marketability. Therefore, the student may be locked into this field and may lack the flexibility to react to changes in market conditions. Economists have talked about reservation wages, which refers to the lowest wage for which an individual will work. It makes just as much sense to consider reservation occupations. If new entrants to the labor force are more mobile in their career choices than engineers and physics Ph.D.'s, then this type of model might not be as good at forecasting trends in other labor markets in the long run.

In general, the Freeman-Hansen model has much to recommend it, including simplicity and the fact that it considers both internal and external market adjustments. But as the authors note, their model is "no fortune teller's window to the future." And they add that beyond the forecasts is the "behavior to which the models direct attention." This raises the second set of questions.

POLICY PLANNING NEEDS

The vocational educators' planning needs include sound estimates of the supply of students who will seek vocational training and the demand by employers for workers at various occupational and skill levels. It's quite obvious that a vocational education forecaster has to take into account all sorts of variables, including levels of employment and unemployment, changes in productivity, hours of work, technology, and public policies. For example, will we continue with a volunteer armed service or resume conscription? Will Congress adopt new immigration policies? Given the state of the econometric art, vocational educators will need much more than computer models to obtain reliable estimates for informed planning.

The computer models cannot predict the outcome of these political decisions. But once the direction of these policies is determined, many vocational education planners have a better feel for the impact of new policy direction than do the computer models. In other words, what they would really like to know, the models cannot tell them. And what the computer models can tell, many vocational educators already know from long years of firsthand personal experience.

Despite estimation problems, there are indications about the supply of students who will be seeking vocational education in the 1980s. In this decade fewer young peole will reach working age than in the 1970s. The annual increase of these potential young workers should be about 1.6 million in the 1980s compared to 2.4 million in the last decade.

But while the total population of teenagers reaching working age may decline, other forces at work could have a significant impact on the number and type of young adults seeking vocational education services. One factor is the shift in federal educational policies. The current administration, according to Urban Institute estimates, would cut federal outlays on student assistance for higher education by more than half from $10.8 billion in fiscal 1982 to $4.4 billion (in 1982 dollars) three years later (Palmer and Sawhill 1982).

At the same time, state and local spending for education is barely keeping up with inflation, and in many states it is falling behind the increase in prices. Also, research by Richard Nathan (1982) of Princeton and the Urban Institute indicates that state and local governments cannot, or will not, take up most of the slack left by the federal government's retreat. This means that as a result, a growing number of students will not be able to afford a college education. Former college-bound youths might shift their direction and seek vocational education. In addition, given the loose labor markets anticipated in the next few years, it is highly doubtful that the economy will be able to generate enough so-called college-required jobs for almost a million new college graduates every year. This means that traditional vocational education students will have to compete with other students who in the past would have gone on to college. Also, a growing number of students with some college experience will seek vocational education and training so that they can land jobs in an era of high unemployment.

Military recruitment policy also will have a major impact on the supply of students seeking vocational education. A change from the all-volunteer military to conscription, even without change in the force level, would affect the supply of teenagers seeking vocational education. The all-volunteer system may include many persons who might seek civilian vocational training if the option to enlist in the military were not available. The mix of military and occupational training might also change if conscription were reintroduced. According to estimates by Rupert Evans, the military provides about 700 million trainee hours per year, compared with 6 billion trainee hours per year offered by public vocational education. Civilian vocational educators should not ignore the training provided by the military, especially since conscription may change the quality as well as the content of the training.

But supply is only one blade of the scissors, and vocational educators must also consider the demand by employers for these trained workers. This requires analysis of the impact of macroeconomic policies. President Reagan's fiscal and monetary policies have not produced the rapid growth in GNP and employment levels that he predicted. The problems of major budget deficits and their impact on the financial markets will remain for many years. This indicates that employers and the vocational education community in the immediate years ahead will have to face an economy burdened by high levels of unemployment.

Beyond the macroeconomic level, there has been a growing concern about so-called policies to reindustrialize our economy and vastly increase the pace of technological change. Microcomputers and industrial robots have captured the headlines, and vocational educators should examine the impact these technological changes will have on various industries, occupations, and skill needs.

However, indications are that the occupational changes will not be as swift as is often indicated by analysts of computer technologies. In fact, the evolution—and not revolution—in occupational structure should not present grave challenges to vocational educators. Analysts are coming to realize that many factors limit the speed of diffusion of technological change and thereby mitigate possible employment implications. The size of required investment, the rate of capacity utilization, and the institutional arrangements within industries all can act as "economic governors" that slow the adoption of automated technologies. Virtually all capital-intensive industries have a massive investment in existing plant facilities, and they cannot afford to squander these resources through the wholesale replacement of working machinery. More importantly, the financial constraints on capital formation necessarily limit the rate at which new technologies are introduced. Vocational educators will have to adjust their courses in the face of shifts in technology, including more courses in basic computer skills, but these changes should be manageable.

HOW MUCH FORECASTING?

Given the tight budget constraints that vocational educators are facing, the benefits to be obtained from forecasting models should be measured in light of their costs. Based on the current record, the unavoidable conclusion is that, at best, computer models can make only a marginal contribution at present. This may change in the future as econometric hopes spring eternal.

As indicated, technology and occupational mix will be changing, but not at a much faster pace than experienced in the past. Of course, vocational educators cannot ignore these shifts. They will have to follow them closely and make the necessary adjustments as required by the ongoing changes. But even the most sophisticated mathematical models will be of marginal assistance in planning these adjustments. Vocational education planners would do better by keeping in constant touch with local employers, labor representatives, and job employment services staff. The information that they can obtain from these sources will be more relevant to vocational education planning than computer models.

However, even the best forecasts of aggregate national conditions may be of little value to local vocational educators. Indications are that not only will the recovery be slow, but it will be highly uneven in different local labor markets. If military spending is to be a major touchstone of economic growth in the 1980s, then many labor markets will be almost unaffected while others could experience skill shortages.

The application of national models to state and local needs is usually a frustrating exercise, and the results are normally misleading and may be no better than wild guesses. Vocational educators will have to look at national data, but they will have to depend on knowledgeable local sources to reinterpret information to their local economies.

Stressing reliance upon local data sources should not be interpreted as a rejection of occupational forecasting. But a heavy allocation of research dollars into national econometric models and computer simulations will be of little help to vocational educators serving local markets, even though the products of vocational education—the trained individuals—may be mobile and may venture far away from the location of their schools. We ought to spend some of our budgets on these statistical efforts but keep consulting other sources for information and analysis. Although, as a firm believer in full employment, I would recommend some outlays for building occupational forecasting models if unemployment hits labor economists. However, once economic conditions improve, labor economists should find more useful work than playing with occupational forecasting models.

We all like to know what the future will bring, and that is why we have so many tea leaf and palm readers. Some might suggest that modern-day forecasters who go to computers for their answers do no better than the old-fashioned soothsayers, and that they do not do as well as the Greek oracles. The Delphic oracle retained its reputation because it never forecast a precise result. Today's forecasters might do well to study the techniques of that oracle.

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Early Warning Systems

8

MARC A. MATLAND

An Early Warning System to Improve the Responsiveness of Vocational Education and Training Institutions to Changes in the Local Labor Market Demand for Workers

SUMMARY

Historically, educators have faced serious problems in attempting to use projections of labor requirements for planning vocational and technical education program offerings. While in most cases the projections have proven reasonably sound at the national level, they lose much of their accuracy when disaggregated to the local level. A system for forecasting labor demand at the local level, however, could have many advantages for planning educational programs at vocational institutions. This chapter describes several efforts to prepare staffing requirements data at the micro- or plant level. These efforts suggest that an Early Warning System (EWS) is technically feasible and useful for the development of special education and training programs designed to improve the match between the skills of graduates of local vocational and technical schools and the skill requirements of major local employers.

The Value of an Early Warning System

The EWS described in this paper was initially directed at forecasting labor requirements for specified government construction or manufacturing procurement awards. The special advantages of this approach were thought to be that the anticipated demand for workers would be based on contractual commitments on the part of the government and would be more certain than if the demands were based on corporate procurements. In addition, this data base of information on labor demand would be available through the offices of the U.S. Department of Labor and the U.S. Department of Education.

Moreover, it was believed that the involvement of the contracting agency and the contractor would ensure the development of sound labor demand projections released sufficiently in advance to provide technical education institutions with the lead time needed to put program offerings in place, train students, and provide graduates to fill prospective job vacancies. The cooperation of the contracting agency and contractor in this system could be expected, since it would be in the self-interest of both the government and the employer to avoid labor bottlenecks and to reduce the upward pressure on wage rates that could arise from labor shortages, and that could result in time delays and/or cost overruns. Furthermore, the participation of the prospective employer would have the added advantage of increasing the likelihood that graduates of the vocational education and training programs participating in the EWS would find employment after completing their training.

Experience with the Early Warning System

Over the past ten years, there have been two efforts to examine the feasibility of an Early Warning System. The first was supported by the Office of Research and Development of the U.S. Department of Labor and the second was an adjunct effort to the Carter administration's White House "rural initiative."

The first EWS effort was a research and pilot program to test researchers' ability to predict the character of employment generated by major government procurement awards. The program also tested the feasibility of using such information to design and launch vocational and technical education and training programs to provide graduates in time to meet labor demand as it developed. The idea of focusing on government contracts was to capitalize on the data and influence the federal procurement agency would have vis-a-vis the prime contractor. The leverage exercised by the procurement agency could be used to enhance the effectiveness of the U.S. Department of Labor and the then U.S. Office of Education—the two agencies which were mandated to provide employers with the trained work force they required and to train job seekers with the skills needed for success in the job market.

The White House's rural initiative represented an effort by the Carter administration to coordinate the work of the various federal departments in order to improve the likelihood that each agency's mission would be accomplished without additional resources. The U.S. Army Corps of Engineers' river improvement projects, for example, would be coordinated with programs of the U.S. Department of Labor, the Small Business Administration, the Economic Development Administration, the U.S. Department of Education, and other agencies. By coordinating not only the work of all relevant federal, state, and local agencies, but also the work of the private sector in the locale where the procurement award was to be performed, it was hoped that the goals of each agency would be more easily achieved without raising funding levels for the agencies. The rural focus of the initiative reflected the view of some key decision makers that in a time of severe resource constraints, the deteriorating conditions in rural areas required special attention.

The role of the EWS in the rural initiative was to provide local coordinating committees (called Project Area Councils or PACs), with the basic data needed to link local vocational-technical programs with the job vacancies generated by federal procurement projects. In this effort, the EWS relied more heavily on data provided by the contracting agency and the employers than had been the case in the earlier research and development project under the Department of Labor. The influence of the White House and the involvement of high-level agency decision makers ensured both the cooperation of the procurement agencies and the availability of projected job vacancy data. The role of the EWS, therefore, concentrated more on the interpretation of the demand data and the provision of a variety of labor supply information. The EWS developed and collated data on the availability of workers by occupation in the labor recruitment area; on vocational-technical education and training programs and specific courses of study offered in the locality; and on race, sex, age, and ethnic background of the local population. (This last category of data was gathered for use in designing equal employment opportunity and affirmative action plans for the project.)

The first EWS effort included four major construction and procurement awards ranging from the manufacture of nuclear submarines in Groton, Connecticut, to the production of the space shuttle's main engine in the Los Angeles area. Also included were the construction of a lock and dam complex on the Ohio River near Paducah, Kentucky, and the manufacture of over 700 subway cars in

Chicago for the New York City transit system. This latter project was funded by a grant from the Urban Mass Transportation Administration.

The rural initiative projects included the construction of the Red River Waterway and the Tenn-Tom Waterway in the Gulf Coast region for the Army Corps of Engineers; the construction of a dam for the Bureau of Reclamation in Oklahoma; and two private construction projects in the state of Washington.

Significance of the EWS Experience

The fact that the EWS was reasonably successful in facilitating the development of special education and training programs to meet the staffing needs of employers on specific projects indicates that the approach is feasible over a broad range of products, industries, geographic regions, and contracting agencies.

The most striking aspect of the system is its ability (with the aid of employers and procurement agencies) to provide time-phased projections of labor demand by occupation and to provide these projections far enough in advance that vocational-technical institutions can respond.

THE RESEARCH AND DEVELOPMENT EFFORT

The U.S. Department of Labor's research and development effort included four major federal procurement awards in a variety of industries located in different regions of the country, and involved a number of different contracting agencies. These awards were selected because of their large size and their industrial and geographic diversity. They were also considered to be representative of the variety of types of procurements that would be suitable for study should an Early Warning System be found to be feasible.

The awards included a military hardware contract in the shipbuilding industry in the Northeast; a river improvement construction project and a manufacturing contract in the transportation equipment industry in the North Central region; and the manufacture of major components for NASA in the West.

The research and development project incorporated both research and dissemination elements. The research component concentrated on the design of a simple, replicable system for selecting major federal procurements suitable for the EWS, the identification of relevant data sources, and the development of a methodology for preparing reliable estimates of future local staffing requirements based on the needs generated by these procurements. The dissemination component was intended to test the usefulness of the staffing projections for planning and establishing special vocational education and training courses, recruiting students, and placing graduates. This required preparing briefing materials and conducting workshops and planning sessions with federal, state, and local educators, manpower agency officials, company personnel, union representatives, and others in order to bring the research findings to the attention of local planners and decision makers. This component also heavily emphasized the provision of technical asistance to these parties to facilitate the design of vocational education and training activities related to the federal procurements under study.

In addition, the dissemination effort included a follow-up role for the EWS to assess the degree to which the output of the research and technical assistance functions had been incorporated into local education, labor, and corporate plans.

The results of the research and development effort indicated that time-phased projections of demand by occupation could be prepared and that arrangements for the placement of program graduates could be made between state and local officials responsible for occupational training and education and the contractor/prospective employer.

The Research Effort

The research component was designed to test the system's ability to identify the demand for workers by occupation over the life of the procurement. Special attention was paid to the timing of the demand for workers in different occupations as this was obviously a critical element in the job matching process. It was clear that any given procurement would require workers in different occupations at different phases of the work. For example, in a new program the initial efforts involve research, development, and design functions that require large numbers of scientists, engineers, and special technicians. Next is a "tooling-up" period that emphasizes the employment of highly skilled machinists, toolmakers, millwrights, and so on. Finally, there is a production phase that requires a broad range of workers at many skill levels.

For a system such as the EWS, such staggered labor demands are an advantage as they provide for a period of at least eighteen months from the time of the original procurement before the major demand for workers occurs. It is this lead time that can be so valuable to educators and labor planners in planning and establishing special vocational and technical education courses.

The EWS staff reviewed over a dozen large awards before selecting the four case study projects. In all cases, the staff was able to examine the original agency materials used in preparing the project specifications, the contractor's detailed proposal, and information on similar awards—all items that proved useful in estimating labor requirements. Some of this material was available in the national office of the contracting agency, some was found in its regional or district offices, while other data were obtained directly from the prime contractor.

The Office of Research and Development of the U.S. Department of Labor, which supported the research and development effort, was instrumental in obtaining the cooperation of the contracting agencies and, through them, the cooperation of the prime contractors. The only information not available to the EWS staff was classified material relating to the defense and aerospace projects. These materials, however, would not have contributed to the development of staffing requirement projections and thus did not prove to be a handicap in the development of the EWS.

The research methodology used was simple, replicable, and sufficiently flexible to accommodate the variety of data and data sources found to be available. The procedure involved a measure of the work load covered by the procurement award broken down into monthly, semiannual, or annual periods; a "labor coefficient" relating work load to the number of worker-months or worker-years of in-plant labor required; an estimate of the occupational distribution of the required work force; and a job vacancy measure to account for personnel with recall rights and for replacement needs caused by deaths, retirements, and discharges (National Planning Association 1974, p. 9). The final tabulation of these data provided information on job vacancies by occupations time phased over the life of the procurement.

The required data were found to be available from a wide range of contracting agency and company sources. For example, in estimating reasonable costs and time considerations, the U.S. Army Corps of Engineers produces data on material, dollar, and labor requirements for each component work task of a construction project. Additionally, the Davis-Bacon Act requires that the employer's payroll data on wage rates, hours worked, and occupation for each employee be filed with the contracting agency. In one form or another, these data provide all the information required by the EWS procedure (ibid, Appendix I). Another example of the types of data available from contracting agencies and contractors that meet the data requirements of the EWS is the practice followed by NASA in its major procurement awards. NASA prepared "labor curves" estimating the number of worker-years required in broad occupational categories over the life of the award. Similarly, the firm that received the contract estimated the production worker requirements for each department in the plant, which included projections of demand for a number of key occupations (National Planning Association 1974).

In the case of the subway car manufacturing procurement award, the New York City Transit Authority estimated production over the life of the award in order to schedule payments to the contractor in synchronization with the Authority's budgeted income from the Urban Mass Tansportation Administration. This provided a basis for distributing the work load over the production period and was the key element in projecting job vacancies by occupation (National Planning Association 1974). The range of information available from contracting agencies and contractors suggests that planning for most major federal procurement awards provides the data base necessary for the successful application of the EWS estimating procedures.

The Dissemination Role of the EWS

In this phase of the research and development effort, the EWS personnel disseminated the results of the research component and coordinated the interaction between training and recruitment program planners and the contractor/employer. This involved both the preparation of special briefing materials outlining the results of the research effort and the clarification of significant findings—including the potential labor bottlenecks and shortages in key occupations. These materials formed the basis for meetings organized in each locality, which were attended by representatives of vocational education, local labor planners, the contracting agency and the contractor, and representatives of the local political leadership.

At the time of this pilot project, federal manpower training resources were appropriated under the Manpower Development and Training Act and were controlled by state and local Manpower Area Planning Councils and federal and state labor and education agencies. The Manpower Area Planning Councils or MAPCs were also represented at the briefing sessions, and Manpower Development and Training Act funds were tapped as well as regular vocational education resources.

Results of the Research and Development Effort

The most successful EWS pilot projects were the shipbuilding and the subway car manufacturing awards. In these two cases, the local and state vocational education establishment, with the assistance of the state and local political leadership, succeeded in establishing special training programs to prepare workers for the job vacancies generated by the procurement awards.

Although significant problems arose in the shipbuilding industry project because of the method of allocating training funds by county, a decision by the governor's office to provide the additional funds from other sources resulted in approximately 1,000 trainees being enrolled in vocational programs to meet the prospective staffing needs of the contractor.

In the subway car manufacturing award, the contracting company and local education and labor officials agreed to design a cooperative system under which the Chicago area job service would launch a special recruitment drive for workers. Vocational trainers would then establish training programs for jobs that could not be filled through these recruitment efforts. Under this arrangement, local education and training funds were used for recruitment and/or training purposes, while the company provided detailed information on job skill requirements and curriculum content as well as on some of the required training equipment and/or facilities.

In the case of the lock and dam complex on the Ohio River, it was determined that the only shortage of workers would occur in special welding classifications necessary because of government construction regulations. As these workers were in short supply nationally (thus out-of-state recruitment was not expected to satisfy the demand) a "stretchout" of the project was considered probable. One of the sources of newly trained workers in specialized welding crafts was the Oak Ridge Training Center in Tennessee—a facility supported by federal training funds. The company had not been aware of this institutional source of trained workers. Although no additional classes were scheduled at the facility due to resource constraints, the company made arrangements to use the school as a source of skilled workers.

A more significant result of the EWS effort with the Corps of Engineers was the establishment of a union-sponsored training program for upgrading the skills of underemployed operating engineers in the area of the lock and dam construction site. Under the leadership of its vocational education members, the Kentucky Manpower Planning Council and the Kentucky Department of Manpower Services arranged for the development of training programs for operating engineers in Kentucky. A variety of students, including women and minorities, were trained in the program. Many of them were not union members. Some were hired by the government contractor for work on the Corps of Engineers' project while others moved directly into the mainstream of highly skilled, well-paid construction trades jobs. The program was considered so successful by the state agencies that it was refunded annually by the Kentucky MAPC.

The EWS was less successful in organizing special education and training programs in the aerospace industry. As these contract procurements were still in the early phases of research, staffing requirements for the production phase (while expected to be in the thousands) could not be detailed by occupation until the product designs were near completion. The contractor and education and labor program officials did agree, however, to remain in contact so that staff shortages could be identified early enough to institute the necessary vocational and technical courses.

THE WHITE HOUSE'S "RURAL INITIATIVE" AND THE EWS

The most recent effort to institutionalize the EWS was initiated under the aegis of the Carter administration's White House rural initiative. This program grew out of the commitment of President Carter, Secretary of Labor Ray Marshall, and others in the administration to a special attempt to coordinate the activities and resources of various federal departments to bring the benefits of economic development to job seekers and small and minority businesses in rural areas.

The initial output of the White House program was a set of planning and implementation guidelines that specified general procedures for the initiative; allocated responsibilities among the various federal, state, and local agencies and other parties to the program; and specifically mandated the U.S. Department of Labor to establish an EWS (The White House 1980). The responsibilities of the EWS were to develop and publish the necessary data on staffing requirements, sources of labor supply, and training facilities for use by the participants in the rural initiative in planning and establishing special training, recruitment, and placement programs.

Four demonstration sites were selected by the White House for testing the rural initiatives. The largest project was the Tenn-Tom Waterway Project funded by the U.S. Army Corps of Engineers in Mississippi and Alabama. This project has been underway for over a decade and is expected to continue for another several years before being completed. It involves the construction of locks, dams, and embankments over a distance of several hundred miles. The second project selected as a demonstration was the Red River Waterway Project in Louisiana. This project, also funded by the Corps of Engineers, is similar in scope to the Tenn-Tom but is of somewhat smaller magnitude.

The third construction project included in the rural initiative was the construction of a dam, site clearing, and access road in Atoka County, Oklahoma. This construction project was financed by the U.S. Department of Interior, Bureau of Reclamation and, while expected to supply drinking water to Oklahoma City eventually, was of much smaller size than the two waterway projects.

The final construction projects selected were two dissimilar but neighboring work sites that were to be handled in tandem under the rural initiative because each was a large effort in a rural area and would clearly overtax the limited local work force. Thus, there would be a substantial need for new training activities. The projects were both privately financed. One was for the construction of a complex of coal-fired electric generating plants in or near Creston, Washington, and the other was for the construction of a copper-molybdenum mine and related facilities on the nearby Coleville Confederated Tribes reservation.

The EWS and the PACs

Due to the support of the White House and the assignment of high-level contracting agency personnel as members of the local Project Area Councils (PACs), the need for independently prepared and validated staffing projections for these projects was minimal. The contracting agency, with the cooperation of the prime contractors, developed and updated the labor forecasts. The role of the EWS, therefore, shifted to the identification and collection of data on training and population characteristics and the solicitation of cooperation from data suppliers that were not being utilized by the PACs. These data included the number of job orders by occupation and those remaining unfilled for thirty days (a measure of occupational shortages and surpluses) as supplied by the state job service; the size and location of nearby apprenticeship programs as supplied by the Bureau of Apprenticeship and Training of the U.S. Department of Labor; the availability of local vocational training programs by craft as supplied by the U.S. Office of Education; and estimates of the race, sex, and other characteristics of the working age population in the recruitment area (information that was available from a special project of the Lawrence-Berkeley Labs in California). The EWS then assessed the significance of these data for the establishment of special training and recruitment efforts. None of the data provided by the EWS had been previously tapped by the PACs.

EWS ACCOMPLISHMENTS

A number of significant innovations resulted from the involvement of the EWS with the PACs. At the technical level, data sources were identified and data that contributed to the development of a variety of education, labor, and related efforts were analyzed. For example, estimates of the race, ethnic background, and sex of the working-age population were provided by the EWS as a basis for special recruitment and training efforts to place minorities and women in the job vacancies created by the procurement award. Another example of the accomplishments of the EWS was the listing of vocational training institutions that could be used in the training effort but that were not in the immediate vicinity of the work site and therefore had not been invited to work with the PAC. Similarly, the EWS provided lists of community-based, nonprofit organizations that could be used to perform many of the special supportive services needed by local disadvantaged, minority, and female job seekers during training.

Programmatic outcomes resulting from the work of the EWS included the preparation of special lists of minority-owned firms classified by industry. These lists formed the basis for the prime contractor's solicitation of small and minority businesses as subcontractors or suppliers as required by federal regulations. The use of such information occurred in all three of the federal procurements. In the case of the Tenn-Tom and Washington State PACs, applications for additional training funds were made to the Balance of State Private Industry Councils established under Title VII of CETA. These funds were to supplement local training resources for the Alabama portion of the Tenn-Tom project and for the mining project in Washington.

In addition, special training programs offered by vocational training institutions, CETA prime sponsors, and unions were incorporated into the PACs' labor plans. Similarly, locally and nationally organized community-based organizations were invited to join the PACs and to contribute their services in recruiting minorities and women, and in providing supportive services to local job applicants.

Unfortunately, some of these efforts failed to bear fruit. With the downturn in the overall economy and the location of new sources of molybdenum, the mining project in Washington State has been terminated and all training and related programs have ceased. Similarly, organized planning for the training of workers for the electricity generating plants in that state under the PAC have also ended as the cutbacks in federal human resources program funds have limited the resources available to the PAC.

In the case of the Oklahoma Bureau of Reclamation project, however, the PAC is continuing to operate using state funds. The Tenn-Tom Waterway PAC is also still operational under the aegis of the states involved. Given the state of the economy and the priorities of the present administration, these successes are striking.

What stands out from the "Rural Initiative" experience is that (1) the sources of data used by the EWS were largely unknown to the PACs until supplied by EWS staff; (2) these data could not have been assembled and analyzed by the PACs because of the wide-ranging responsibilities assigned to them and the small staffs available to them; and (3) many of the education and labor outcomes would not have resulted without the data and assessments provided by the EWS.

There will, therefore, continue to be a need for a centralized Early Warning System function as long as planning groups such as the PACs do not have competent and experienced local staff whose major responsibility is planning for the education and labor program impacts of large procurement awards.

CONCLUSIONS

The results of both the research and development and the "Rural Initiative" EWS efforts indicate that the system can function effectively as a tool for vocational education planning at the local level. The EWS was able to develop or assemble time-phased job demand data by occupation and other information with the lead time necessary to plan and establish vocational education and training programs and to train students with the skills necessary to fill the anticipated job vacancies.

The EWS is an alternative to having each recipient of a major procurement award develop its own staff, set in place procedures for anticipating staffing requirements, and develop local linkages with vocational education institutions. The experience with the EWS over the past ten or so years indicates that many employers are either not able to or not interested in producing the required data or not skilled in coordinating their activities with local training institutions.

There is a special need for a mechanism such as the EWS in cases where the local employer relies on casual or ad hoc staffing (i.e., recruiting workers at the time the demand arises or paying premiums to attract the needed workers). An EWS is also essential in cases where the company is without the capacity to undertake sophisticated labor planning. As further support for the EWS concept, both the research and development effort and the "Rural Initiative" demonstrated that even in those cases where the job vacancy projections could have been prepared by the employer or the contracting agency, the data were generally found to be in a format not readily useful to vocational educators or government labor planners. When such situations occur, the EWS is needed to convert company or agency estimates into a form useable in planning vocational course offerings.

Another limitation of the data prepared by agencies is that, by and large, these data are prepared only for the purpose of estimating reasonable costs for the overall project. Once the project is contracted and the base price is negotiated, no additional job vacancy projections are prepared even though changes in production practices or the impact of unanticipated delays or speed-ups in contract performance may significantly alter the level and timing of the demand for specific crafts.

Even when the contractor or contracting agency is an adequte source of job vacancy projections, effective program planning requires additional information on available worker supply, sources of training, and the characteristics of the local labor force. All of this information is necessary for planning and developing appropriate training efforts.

These additional functions can be most readily provided by an Early Warning System—especially when the company has had no prior experience or contacts with other participants in the job-matching system such as the vocational education establishment or the state job service.

Certain cautions should be noted in any effort to initiate an EWS. Even in the case of large procurements, a considerable portion of the total award normally finds its way into subcontracts or into the purchase of supplies and equipment that are to be used in other localities. The subcontracts may also involve (and usually do involve) different occupational needs than those required at the prime contractor's facilities. The forecasts, therefore, must take into account only the occupational requirements for the "value added" by the prime contractor. In some cases, this amount may not warrant the involvement of the EWS.

In addition, in many cases the award of a contract for a particular product is merely a substitute for another contract that is nearing completion. The workers on the old contract may be merely transferred to work on the new award, and no new job openings may arise other than those from normal attrition. This would usually be too small a number of openings to involve an EWS.

In many cases, however, the types of workers and occupations needed at the start-up of a new award will be different from the types used on current projects. The existing work force will also be disbanded—not merely transferred from work on the old contract to work on the new one. In these cases, an entirely new work force may be hired. Such situations will provide a substantial number of new job openings and opportunities for vocational educators to provide local job seekers with the required skills. It is on this potential job market that the EWS can and should focus.

A MODEL EARLY WARNING SYSTEM

The EWS experience chronicled in this chapter suggests that the system is probably best suited to large procurements because of the number of job vacancies involved, the availability of more data on large awards, the effort required to organize relevant data, and the need for coordination of the active parties. Small contracts may not involve a sufficient number of jobs in any single locality to warrant the investment of the necessary planning resources. At the time of the original research a floor of $25 million was felt to be the minimum contract amount warranting inclusion in the system. In the 1980s, this amount is likely to be more on the order of $50 million or more.

The EWS will undoubtedly be most useful for short-term training programs since this training can be more immediately responsive to the demand projections. The longer in advance the projections are made the greater chance for error because of changing conditions such as the delay of the start of full production (due to design problems in the early stages of the project), or a change in production methods because of new technology or more detailed corporate planning. When such things occur, changes in the demand for workers can be expected and the original projections may mislead the vocational education planner. With longer term vocational education courses (which may be less flexible), even frequent updating of the projections will not be the answer.

However, since vocational educators provide short-term as well as long-term training, the vocational education establishment can find the EWS a useful tool for planning shorter term training under such progams as CETA or adult vocational education. This is not to exclude the use of the EWS in planning longer term vocational programs. In such cases, however, the EWS would probably be most helpful in identifying potentials for expanding existing offerings instead of serving as a basis for substantial investments in new programs.

A model Early Warning System would provide job vacancy forecasts when such information is not available from other sources;

provide technical assistance where needed to aid the contractor or contracting agency in preparing such forecasts; update or induce contractors to update earlier job vacancy projections; compile data on the availability of workers in the required crafts; establish information on training capabilities (both long- and short-term) of local vocational education institutions; and provide materials on local population characteristics. In addition, an EWS could also provide the leadership for bringing together the institutions needed to plan and establish special vocational programs necessary to avoid the staffing problems that can, and normally do, arise when a major new procurement results in changes in the local labor market demand for workers.

What comes through most clearly from the EWS experience is that such a system can operate in a variety of industries; with both government and private sector procurements; in different regions of the country; and in rural and urban settings. The program can accommodate a wide range of government agencies and diverse types of data sources, and can assume different roles as circumstances dictate. With such versatility, it is clear that the EWS can make a significant contribution in meeting both the planning needs of vocational education and the skill requirements of local job seekers and employers.

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9

PAT CHOATE

An Early Warning System: Reactor Comments

Human resource projections have long been the weakest of the management tools used by vocational education administrators. National projections do not disaggregate well—that is, they lose their accuracy to the extent of becoming virtually useless at the local level. Local projections on a standardized basis do not otherwise exist.

Yet, there is a need by training administrators for accurate information on the training requirements of employers. There is a special need for short-term information about specific jobs in specific companies by specific time periods.

Marc A. Matland describes four experiments, funded by the U.S. Department of Labor, that attempted to develop a replicable technique that can help close this information gap. Specifically, the objective of the experiments was to create an Early Warning System (EWS)—an information system—that could create reliable estimates of staffing requirements in time to create training programs that would meet these specific training needs.

The experiments used four major federal procurement awards as the source of the employment information. There was diversity in these four procurement projects. Specifically, they included a shipbuilding contract, a public works project, a manufacturing contract for transportation equipment, and the manufacture of aerospace components for NASA. The experiments were designed to be simple and, if successful, replicable.

Though there were variations in the experiments, each was successful in providing time-phased projections of occupational demand with sufficient lead time to permit training institutions to design and provide training tailored to these specific needs.

The principal findings of this project are the following:

- Employers will share information about their training needs if there is a reasonable expectation that the training institutions can help fill those needs.

- When government procurement is involved, sufficient nonclassified information is available to prepare staffing requirements in enough detail and with enough lead time to permit the creation of specialized training programs. For example, as a normal course of its projects, Matland reports, the Corps of Engineers produces detailed data on material, dollar, and worker requirements for each component work task of a construction project. Though the form of information varied from project to project, adequate basic data, often from standard sources, also were available from the other projects.

- When given accurate information, public vocational programs will respond to the needs of specific employers if they are able.

- Using improved information, training programs can be coordinated with union-sponsored efforts. In fact, Matland reports that a union-sponsored training program for upgrading the skills of underemployed operating engineers in lock and dam construction proved sufficiently successful that it has been continued. Also, students were not limited to union members; indeed, trainees in this program included women, minorities, and several nonunion trainees.

Based on these four large experiments, Matland concludes that the EWS is quite useful and can be replicated. He also concludes that the EWS is an alternative to having each recipient of a large government procurement contract reinvent procedures for developing labor projections. He stresses that there is a special need for a mechanism such as EWS for firms with little experience with human resource planning, so that ad hoc company data can be translated into a format usable by vocational administrators. Matland concludes that the EWS can be created for virtually all types of industries and is especially useful for "short turnaround time" training programs with specific demands to fill.

Finally, Matland notes that an EWS can provide a number of quite useful benefits, including (1) providing technical assistance to aid employers and trainers in preparing human resource projections; (2) compiling basic data on the supply of available workers in specific occupations and crafts; (3) assessing the short- and long-term capacities of training institutions to meet these needs; and (4) being the catalyst for bringing together employers and trainers to create and conduct needed training programs. Of course, job seekers clearly benefit from having training linked to specific jobs.

The experiments and Matland's description of them are very useful contributions to the field of human resource training and administration. They demonstrate rather conclusively that it is possible to create and operate effective information-gathering programs on short-term, company-specific training needs. Indeed Matland understates some of the likely benefits that can accrue from having an EWS.

Specifically, it is logical to assume that if the EWS is able to create effective data even as an experiment, even more precise information will be produced over time from a fully operating EWS. With experience, the EWS personnel will become more adept at their jobs. As firms develop confidence in the EWS and the ability of the vocational education system to respond, the firms are likely to be even more forthcoming. Equally important, if this system can work on government procurements, it can work on nongovernment procurements as well. After all, there is little difference, from an operational and human resources planning perspective, between manufacturing aerospace components for NASA consumption and manufacturing the same or similar components for use by a major airplane manufacturer. The same is true for construction projects. All projects, public or private, involve lead times and worker needs—both of which, it appears, can be accurately projected.

Thus, the important challenge raised by Matland is not, Can reliable, job- and employer-specific, short-term data be created? (the experiments Matland describes prove it can); but rather the pivotal question is, How will America's vocational education system be modified to provide the training that the EWS identifies? At present, in too many places vocational education is insufficiently flexible to respond to the short turnaround demands for training. Facilities are limited; faculty do not possess state-of-the-art skills; and equipment is obsolete or nonexistent. Having good information is useless if the vocational education system cannot respond to the demands that the EWS identifies.

Thus, the next steps are both (1) to make the "experiments" of EWS an operational reality by creating an EWS in each state and (2) to address the issue of improving the flexibility of America's vocational education system. Both are critical challenges. Matland's discussion is a useful contribution, since it points the way to meeting the first of these challenges.

CHARLES DALE

10

The Employment Effects of the Defense Budget: A Descriptive Survey

INTRODUCTION

The possibility that increases in defense expenditures may create shortages of skilled labor in critical areas has caused concern in Congress and generated heated debates among economists. This chapter surveys the rapidly growing literature on the effects of defense expenditures on skilled labor requirements, provides projections of key skilled labor demands, and discusses how vocational educators may respond to changing needs in this area.

OVERVIEW

U.S. Department of Defense budget projections through 1987 are shown in table 10-1. There will be strong real growth in both obligational authority (funds committed during the fiscal year but not actually spent) and outlays (actual expenditures). These increases will reverse recent spending trends, since defense expenditures actually

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TABLE 10-1

FISCAL YEAR 1983 DEFENSE BUDGET PROJECTIONS
(Billions of Dollars)

	FY82	FY83	FY84	FY85	FY86	FY87
Total Obligational Authority:						
Current Year Dollars	$214.2	$258.0	$285.5	$331.7	$367.6	$400.8
Constant (FY83) Dollars	227.8	258.0	269.8	297.8	314.0	325.9
Real Growth Rate (%)	12.7	13.2	4.6	10.4	5.4	3.8
Defense Outlays:						
Current Year Dollars	182.8	215.9	247.0	285.5	324.0	356.0
Constant (FY83) Dollars	195.4	215.9	233.2	255.6	276.0	288.7
Real Growth Rate (%)	7.7	10.5	8.0	9.6	8.0	4.6

SOURCE: Weinberger 1982

declined at an average annual rate of 0.5 percent between 1972 and 1980.

Procurement budgets for the next few years are depicted in table 10-2. The far right column shows the sharp across-the-board increases that are targeted for all the services. The U.S. Army will continue buying sophisticated new equipment such as the M-1 Abrams tank and the Bradley Fighting Vehicle System. The U.S. Navy will build TRIDENT ballistic missile submarines, CG-47 guided missile cruisers, and two nuclear aircraft carriers, as part of a five-year plan to add 133 ships to the current total of 514.

All services will increase their purchases of aircraft. The Navy will add two additional carrier air wings—one in FY 1983, and one in FY 1987. Each air wing consists of about 86 aircraft, including F-14 fighters, A-7 light attack planes, A-6 medium attack planes, and others. The Army will spend over $1.5 billion in FY 1983 for 48 new AH-64 attack helicopters and 96 new UH-60 utility helicopters. The U.S. Air Force will buy over 1,100 new F-15 fighters and 480 new F-16 fighters by FY 1987.

TABLE 10-2

DEFENSE BUDGET PROCUREMENT—ALL CATEGORIES WILL INCREASE RAPIDLY

(Billions of Dollars)

	FY81	FY82	FY82 Growth Rate (Percent)	FY83	FY83 Growth Rate (Percent)
Army:					
Aircraft	$1.2	$1.9	58.3%	$2.7	42.1%
Missiles	1.5	2.2	46.7	2.8	27.1
Weapons and Tracked Combat Vehicles	3.4	4.0	17.6	5.0	25.0
Ammunition	1.6	2.3	43.8	2.6	13.0
Other	2.8	3.8	35.7	4.6	21.1
TOTAL ARMY:	$10.5	$14.2	35.2%	$17.8	25.4%
Navy:					
Aircraft	$6.2	$9.1	42.2%	$11.6	27.5%
Weapons	2.7	3.2	18.5	3.9	21.9
Shipbuilding & Conversion	7.6	8.9	17.1	18.6	112.4
Other	3.0	3.7	23.3	4.0	8.1
Marine Corps	0.5	1.7	340.0	2.3	35.3
TOTAL NAVY:	$20.1	$26.7	32.8%	$40.4	51.3%
Air Force:					
Aircraft	$10.3	$14.0	35.9%	$17.8	27.1%
Missiles	3.3	4.6	39.4	6.8	47.8
Other	3.1	5.4	74.2	5.8	7.4
TOTAL AIR FORCE:	$16.8	$24.0	42.9%	$30.4	26.7%

SOURCE: Weinberger 1982

All the services have placed new emphasis on Command, Control, and Communications, or C^3 (pronounced either "C-cubed" or simply "C-three"). There will be, therefore, a strong demand for personnel to operate and maintain communications equipment, as well as other new strategic systems, such as the MX missile and B-1 bomber. The services all have extensive training programs,* but there nevertheless is already a shortage of skilled labor in the Reserves (Weinberger 1982, p. III-169).

A number of studies are examining shortages of skilled labor. A preliminary study of possible future shortages of engineers has been undertaken by the Joint Chiefs of Staff. At the same time the military services are planning a long-term National Manpower Inventory of skilled occupations. Other studies are underway at the Department of the Air Force, the National Science Foundation, and the Bureau of Labor Statistics.

KORB VERSUS THUROW ON THE EFFICIENCY OF THE DEFENSE BUILDUP: IS THERE REALLY A PROBLEM?

There is considerable disagreement about just how seriously defense expenditures may disrupt labor and commodity markets. Opposing views were presented at a June 1982 seminar, The Defense Budget: How Efficient a Build-Up? sponsored by the Public Interest Economics Foundation of Washington, DC. Two of the featured speakers were Dr. Lawrence Korb, assistant secretary for manpower, reserve affairs, and logistics, Department of Defense, and Professor Lester Thurow of the Department of Economics, Massachusetts Institute of Technology (Korb 1982 and Thurow 1982).

Dr. Korb said that the defense buildup will not be inflationary, for several reasons. First, the Defense Department budget's share of the GNP will be low by historical standards. Second, the Reagan administration has an anti-inflation program that will reduce the federal government's share of the GNP from its present 22.3 percent to 20 percent in 1987. Third, there is considerable excess capacity in United States industry. Even at peak levels, the Defense Department will need less than 5 percent of truck and manufacturing capacity, so bottlenecks will not be a problem. In the past, bottlenecks have occurred only in very specific areas, such as aircraft landing gear and tank turrets. Fourth, the Defense Department is working toward multiyear contracting, which will facilitate planning and budgeting.

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*See Cooper and Huerta 1982 and Tucker 1982 for a description of vocational training available in the military services.

Professor Thurow argued, however, that there are three areas where problems may occur in the defense buildup. First, bottlenecks may actually occur in production. Second, there is the potential for creating inflation. Third, and new to this buildup, is the problem of the United States maintaining its international competitiveness.

Professor Thurow said that the most important aspect of the first and third problem is the area of human resources. He asserted that the United States faces severe shortages of engineers and technicians. The problem is exacerbated by the fact that defense not only attracts a large quantity of engineers; it also attracts the best quality engineers. It hurts the consumer sector to have engineers work on glamorous laser weapons rather than on such unglamorous consumer goods as home appliances.

During the general discussion, the participants agreed on the need to reduce shortages of skilled labor. Professor Thurow prefers a broad brush approach, such as another National Defense Education Act (NDEA), to encourage students to study scientific fields. Dr. Korb said that the NDEA was frequently abused by people who used it to major in a discipline such as sociology. He said that the Defense Department is currently working with vocational education specialists to try to determine where specific shortages will occur, so they can be dealt with on a case-by-case basis. A joint Department of Defense/Department of Education seminar on vocational education and the military to be held in Washington, DC, at the end of September 1982 would discuss these issues further.

The analyses of skilled labor requirements described in the next sections fall into three categories: studies that project requirements for the total economy; studies that separate out the defense-related requirements; and studies that also break out requirements by industry and region. All three types of analysis have useful applications.

THE BUREAU OF LABOR STATISTICS PROJECTS RAPID EMPLOYMENT GROWTH IN TECHNICAL FIELDS

The Bureau of Labor Statistics (BLS) makes periodic employment projections for the next decade for a wide range of job categories (U.S. Department of Labor 1980, 1982; Carey 1981; Kutscher 1981; Personick 1981; and Saunders 1981). Tables 10-3 and 10-4 present the Bureau of Labor Statistics' projections of the most rapidly growing occupations over the next decade in terms of percentage growth and absolute number of jobs. Moderate economic growth is assumed over the decade. Note that these employment projections are for the economy as a whole; there is no attempt to measure defense-related employment separately.

One of the most striking characteristics of table 10-3 is the dominance of computer-related occupations. Four of the top six specialties are directly related to electronic data processing. These figures represent projections of recent growth rates and reflect what has been a seemingly insatiable demand for skilled computer technicians. BLS assumes these growth rates will continue through the entire decade.

Aero-astronautic engineers also rank very high in table 10-3, undoubtedly due largely to demands for new aircraft from all the military services. Over 40 percent of all aero-astronautic engineers are employed in defense-related industries, which is a very large percentage for any occupation. A sudden, unexpected increase in defense expenditures for any reason could have a strong effect on employment opportunities in this category. Medical and dental technicians also rank very high. Vocational schools teach many of these needed skills.

The most rapidly growing occupations in terms of the absolute number of jobs are shown in table 10-4. Three of the categories are related to medical specialties. Also of special interest to vocational educators are the projected needs for 221,000 new blue-collar worker supervisors and 205,000 new automotive mechanics by 1990.

In order to determine whether or not shortages will actually occur in a given skill, it would be necessary to have a separate model that would show how the supply situation might change. The creation of such a model, however, is an extremely difficult task. In a recent study of potential shortages of machinists, Rosenthal (1982) stated that "if defense purchases were to rise rapidly during a short time frame and

TABLE 10-3

THE MOST RAPIDLY GROWING OCCUPATIONS—COMPUTER SPECIALTIES DOMINATE THE LIST

	Occupation	Percent Growth in Employment 1978-1990
1.	Data Processing Machine Mechanics	148%
2.	Paralegal Personnel	132
3.	Computer Systems Analysts	108
4.	Computer Operators	88
5.	Office Machine and Cash Register Servicers	81
6.	Computer Programmers	74
7.	Aero-astronautic Engineers	70
8.	Food Service Workers	69
9.	Employment Interviewers	67
10.	Tax Preparers	65
11.	Correction Officials and Jailers	60
12.	Architects	60
13.	Dental Hygienists	58
14.	Physical Therapists	58
15.	Dental Assistants	58
16.	Peripheral EDP Equipment Operators	57
17.	Child Care Attendants	56
18.	Veterinarians	56
19.	Travel Agents	56
20.	Nurses Aides and Orderlies	55

SOURCE: Carey 1981

affect industries in a specific area, the shortage (of skilled machinists) could become so acute that the planned increases in production could not occur." At the same time he asserts, "statistics generated by ongoing government data collection programs do not provide the information necessary to quantify the shortage" (p. 36).

TABLE 10-4

THE MOST RAPIDLY GROWING OCCUPATIONS (NUMBER OF JOBS)—THE SERVICES SECTOR CONTINUES TO GROW

Occupation	1978-1990 Growth in Employment (Thousands)
1. Janitors and Sextons	671
2. Nurses Aides and Orderlies	594
3. Sales Clerks	591
4. Cashiers	546
5. Waiters and Waitresses	532
6. General Clerks, Office	530
7. Professional Nurses	516
8. Food Service Workers	492
9. Secretaries	488
10. Truckdrivers	438
11. Kitchen Helpers	301
12. Elementary Schoolteachers	273
13. Typists	262
14. Accountants and Auditors	254
15. Helpers, Trades	233
16. Blue-collar Worker Supervisors	221
17. Bookkeepers, Hand	220
18. Licensed Practical Nurses	216
19. Guards and Doorkeepers	210
20. Automotive Mechanics	205

SOURCE: Carey 1981

The next logical step toward analyzing the effects of defense expenditures on potential shortages of skilled labor is to break the projected requirements into defense and nondefense categories. The studies discussed in the next section attempt to do this.

DEFENSE EXPENDITURES WILL CREATE MILLIONS OF NEW JOBS

There have recently been a number of studies of the aggregate employment effects of defense expenditures (see Brown 1982; Brown and Doggett 1982; *Business Week* 1982a; and National Science Foundation 1982). These studies all emphasize civilian, rather than military supply shortages.*

The Department of Defense, in conjunction with Data Resources, Inc. (DRI), recently developed the Defense Economic Impact Modeling System (DEIMS). DEIMS, which in its commercial version is called the Defense Interindustry Forecasting System, was developed in part to allow the Department of Defense to analyze the impact of the defense budget on key industrial sectors, skilled labor categories, and raw material requirements (See Appendix).

Tables 10-5 and 10-6 show DEIMS projections of the leading defense suppliers in 1987, in terms of sales and employment. Brown and Doggett (1982) state that defense expenditures "will add significantly to employment levels, with an additional 2.2 million jobs indicated by 1987" (p. 1.50). The principal impact will be on the durable goods manufacturing sector, which alone will add almost 1 million jobs. The fabricated metal products and transportation equipment sectors alone will account for 450,000 jobs between them.

It is important to emphasize at this point that no judgment is being made as to whether or not increasing defense expenditures is a "good" or "bad" way to increase employment. As Brown (1982) noted in a recent address to the National Economists Club, increasing defense spending is not the best way to stimulate the economy, and decreasing defense spending is not the best way to decrease the government deficit. Defense expenditures should be determined primarily according to national security, rather than economic, considerations.

Tables 10-5 and 10-6 do show clearly how dependent many industrial sectors are upon defense spending. Many of the industries listed will have very slow growth rates in their nondefense business. Communications equipment tops both lists, and aircraft and shipbuilding also rank very high. Computer software and hardware are also important.

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*Of course, the movement of skilled labor between the civilian and military sectors is itself a function of the state of the economy (Dale and Gilroy 1983).

TABLE 10-5

THE LEADING DEFENSE SUPPLIERS OF 1987

		Defense Business (Billions of 1980 Dollars)		Average Annual Growth in Defense Business (Percent)	
	Industry	1981	1987	1981-1987	1981 Ranking
1.	Radio, TV, Electrical Equipment	$12.1	$25.2	13.0%	1
2.	Aircraft	7.8	16.4	13.2	3
3.	Aircraft Parts, Equipment	6.8	13.5	12.0	4
4.	Aircraft Engines, Parts	6.4	13.2	12.7	5
5.	Guided Missiles	6.2	12.8	12.9	6
6.	Petroleum Products	7.8	12.3	8.0	2
7.	Business Services and Computer Software	4.8	9.1	11.3	8
8.	Shipbuilding, Repairs	4.9	7.6	7.5	7
9.	Electronic Components	2.6	6.0	14.9	13
10.	Steel	2.9	5.3	10.4	10
11.	Ammunition Except Small Arms	2.3	5.3	15.0	14
12.	Crude Oil, Natural Gas	3.2	5.1	7.7	9
13.	Electric Power	2.8	5.0	10.1	12
14.	Professional Services	2.3	4.7	12.2	16
15.	Truck Transport	2.9	4.6	8.3	11
16.	Maintenance, Repair	2.3	4.0	9.6	15
17.	Chemicals	2.1	4.0	11.3	17
18.	Ordnance, Accessories	1.8	3.7	12.6	18
19.	Tanks, Components	1.5	3.7	12.6	20
20.	Communications Except Radio and TV	1.7	3.3	11.6	19
21.	Machinery including Computer Hardware	1.2	3.0	16.4	27
22.	Semiconductors	1.0	2.8	18.3	29
23.	Motor Vehicles and Equipment	1.3	2.6	12.7	23
24.	Air Carriers	1.4	2.4	9.4	22
25.	Miscellaneous Machinery	1.3	2.4	11.6	24
26.	Engineering, Scientific Instruments	1.3	2.1	9.0	25
27.	Aluminum Fabrication	0.9	2.1	14.3	30
28.	Water Transport	1.4	1.9	3.5	21
29.	Lodging Services	1.2	1.9	8.9	26
30.	Railroads	1.1	1.9	9.8	28

SOURCE: *Business Week* 1982a

TABLE 10-6

THE LEADING DEFENSE EMPLOYERS OF 1987

		1987 Employment (Thousands)			Avg. Annual % Growth 1981 to 1987		
	Industry	Defense	Other	Total	Defense	Other	Total
1.	Radio, TV, Electrical Equipment	501	1930	2431	9.6	2.5	3.7
2.	Ordnance and Accessories	469	88	557	12.6	1.0	10.0
3.	Aircraft, including Parts and Equipment	367	384	751	9.4	2.1	5.2
4.	Business Services, including Computer Software	252	3477	3729	11.4	4.5	4.9
5.	Eating & Drinking Places	233	6690	6923	10.0	0.9	1.1
6.	Wholesale Trade	213	6077	6290	10.9	2.7	2.9
7.	Construction	138	6417	6555	9.4	3.4	3.5
8.	Shipbuilding & Repairing	137	144	281	6.2	0.9	3.2
9.	Professional Services	108	2254	2362	11.8	4.0	4.3
10.	Fabricated Metal Products	96	1648	1744	9.6	2.6	2.9
11.	Educational Services	93	1960	2052	6.6	0.9	1.1
12.	Machinery, including Computer Hardware	86	1464	1550	8.1	1.6	1.9
13.	Motor Freight	84	1510	1593	6.0	2.1	2.3
14.	Lodging Services	67	913	980	8.7	3.2	3.5
15.	Miscellaneous Personal Services	59	2767	2826	9.7	2.5	2.6
16.	Primary Ferrous Metals	58	676	734	8.7	1.0	1.5
17.	Scientific & Control Equipment	54	264	318	8.4	3.8	4.5
18.	Primary Nonferrous Metals	49	393	442	11.0	2.9	3.6
19.	Metalworking Machinery and Equipment	46	459	505	10.6	2.6	3.2
20.	Motor Vehicles and Equipment	41	1026	1067	11.3	2.7	3.0
21.	Communications Except Radio and TV	37	1192	1228	6.7	2.4	2.5
22.	Rubber and Plastic Products N.E.C.	36	868	903	11.7	3.5	3.8
23.	Banking	30	2072	2102	14.5	5.5	5.6
24.	Automobile Repair and Services	30	1371	1401	8.4	1.0	1.2
25.	Utilities	28	866	894	9.1	1.1	1.3
26.	Agriculture, Forestry, Fishing	27	2693	2720	5.3	0.1	0.2
27.	Government	26	16264	16291	8.9	0.2	0.3
28.	Retail Trade	26	12923	12949	11.9	2.4	2.5
29.	Chemicals	22	458	479	8.8	1.5	1.8
30.	Railroads	22	522	543	9.4	3.6	3.8

SOURCE: Brown and Doggett 1982

Only a few occupational groups have a large share of employment oriented toward defense. As previously mentioned, over 40 percent of aero-astronautic engineers are employed in defense industries. All other skilled occupations have less than 20 percent defense employment, and only a few (e.g., aircraft mechanics, machinists, mechanical engineers) have even a 10 percent defense-oriented component. Nevertheless, shortages of critical skills in key areas could potentially cause production bottlenecks.

Brown and Doggett (1982, p. 1.52) identify such occupational groups as mechanical (and electrical) engineers, other professional and technical workers, tool and die makers, heavy equipment mechanics, craftsworkers, transport operatives, and construction craftsworkers as potential problem areas. They conclude that these problem areas may be manageable if resources are effectively managed in the nation's educational and training programs.

Identification of potential problem areas has also been attempted by the National Science Foundation (1982). The NSF uses essentially the same model as Brown and Doggett, under several alternative economic scenarios, but arrives at different conclusions. Part of the reason for this is that the NSF specifically tries to project the supply situation.

The NSF commissioned a study by DauffenBach, Fiorito, and Folk (1982) that analyzes future labor supplies, taking into account labor mobility, immigration, and other such factors. The authors concluded that "With few exceptions it is difficult to draw a conclusion that substantial shortages of engineers and scientists will develop by 1985, *provided we are comparing total requirements with total supply.* Electrical engineering, industrial engineering . . . and computer science (a field that continues to grow at astounding rates) are the exceptions (p. 181).

Attempts to measure supply responses to changing market conditions are complicated by the lengthy adjustment period that is sometimes necessitated by the years of training required to school many types of technicians. For example, chronic shortages in a skilled occupation may lead to sharp rises in salaries. The higher pay may attract hordes of newcomers, resulting in a glut several years later. The glut causes unemployment and lower wages, which discourages newcomers, causing another shortage several years later, and so on. The oscillating pattern of shortage and glut is called a "cobweb effect," after the pattern such dynamic movements exhibit on a supply and demand chart.

Examples of cobweb effects abound. Aerospace engineers were particularly hard hit in the early 1970s, and today there is a shortage of them. Freeman (1975) studied the market for physicists during the period 1948 to 1973 and concluded that "the physics market appears to be well described by a simple model which exploits the time delay in supply due to lengthy training programs. Large numbers of physics graduates create a market setting likely to reduce enrollments and future degrees in the field in accordance with the cobweb scenario" (p. 38).

Supply and demand not only depend upon timing, they also depend upon geography and demographics. The studies discussed in the next section take these additional factors into account.

PROJECTING LABOR REQUIREMENTS BY GEOGRAPHIC REGION— A DIFFICULT BUT NECESSARY TASK

Studies that project the nationwide supply and demand of skilled labor are useful because they allow policymakers to identify potential problem areas. If solutions are to be implemented, however, it is necessary to pinpoint exactly where in the country shortages may appear. In particular, it would be of little use to expect a nationwide shortage of several thousand of a particular type of skilled technician, without knowing precisely in what cities those shortages are most likely to occur.

One regional study was recently completed by Doggett (1981). He used a set of interindustry econometric models to examine the outlook for industries and occupations of potential recruits in ten Air Force recruiting regions that are partly or wholly contained in the state of Indiana. He predicted that demand in occupations common to males aged seventeen to twenty-one will grow more slowly than the statewide average of 2 percent per year, suggesting a generally favorable outlook for Indiana recruiters. He predicted the tighest labor markets will occur in the Evansville and Indianapolis recruiting areas. Labor demand will be slack, and hence recruiting prospects the best, in the Cincinnati, Hammond, and Terre Haute regions. Recruiting prospects in the rest of the state can be considered average.

One of the most ambitious and far-reaching studies of labor demand by region has been undertaken by Pothin (1982). He asserts that skilled labor and engineering categories will suffer shortages ranging from severe to critical through 1990. Previous studies may have demonstrated the categories of greatest need—such as mechanical engineer, computer programmer, to toolmaker—but no regional or local data have yet been developed that would form the basis for coordinated action.

Pothin's objective was to create a micro model for forecasting the needs for skilled labor. Since vocational and skill training are undertaken at the county and local level by either public entities (boards of education) or industrial firms (Pratt & Whitney, Lockheed, etc.), the remedial efforts needed to be grass roots type activities. Also, since the blue-collar work force is concentrated in major manufacturing centers, such as Houston, Pittsburgh, and Los Angeles, Pothin proceeded to explore Defense Department procurement to identify where the Defense Department generated the most person-hours in manufacturing.

Table 10-7 shows one of Pothin's interesting results. Since over 85 percent of all prime defense contractors are located in only seventy-one standard metropolitan statistical areas (SMSAs), he could focus his analysis on this relatively small number of regions. It is interesting to note that Indianapolis is one of the SMSAs, since it was also cited as a potenential problem area in Doggett's study of Indiana.

Pothin is determining the total manufacturing employment in each of the SMSAs of table 10-7, by industry and by occupation. When completed, his data base will show, for example, the number of tool and die makers, drafters, and machinists in any given industry, such as electrical and electronic equipment manufacturing, for each SMSA. Pothin will then forecast the demand for skilled workers in each SMSA through 1988. The projections will include approximately 100 manufacturing skills, including engineering and some scientific fields. The forecast will build in defense-induced employment and other variables, such as local economic growth. By targeting requirements at the local level, the Pothin model will enable policymakers to develop plans to reduce or eliminate potential skills shortages.

TABLE 10-7

WHERE THE DEFENSE-RELATED JOBS ARE—71 METROPOLITAN AREAS CONTAIN 85 PERCENT OF ALL PRIME DEFENSE CONTRACTORS

Standard Metropolitan Statistical Areas (SMSAs)

- ALABAMA:
  - Birmingham
  - Huntsville
  - Mobile
- ARIZONA:
  - Phoenix
  - Tucson
- CALIFORNIA:
  - Anaheim
  - Bakersfield
  - Los Angeles
  - Sacramento
  - San Bernadino
  - San Diego
  - San Francisco
  - Santa Barbara
  - Santa Cruz
  - San Jose
  - Vallejo
- COLORADO:
  - Denver
- CONNECTICUT:
  - Bridgeport
  - New London
- DELAWARE:
  - Wilmington
- FLORIDA:
  - Melbourne
  - Orlando
  - West Palm Beach
- GEORGIA:
  - Atlanta
- HAWAII:
  - Honolulu
- ILLINOIS:
  - Chicago
- INDIANA:
  - Fort Wayne
  - Indianapolis
  - South Bend
- IOWA:
  - Cedar Rapids
- KANSAS:
  - Wichita
- LOUISIANA:
  - Baton Rouge
  - New Orleans
- MARYLAND:
  - Baltimore
- MASSACHUSETTS:
  - Boston
  - Pittsfield
- MICHIGAN:
  - Detroit
- MINNESOTA:
  - Minneapolis
- MISSISSIPPI:
  - Jackson
  - Pascagoula
- MISSOURI:
  - St. Louis
- NEW HAMPSHIRE:
  - Manchester
- NEW JERSEY:
  - New Brunswick
  - Newark
  - Patterson
- NEW YORK:
  - Binghamton
  - Nassau-Suffolk
  - New York
  - Syracuse
- OHIO:
  - Akron
  - Cincinnati
  - Cleveland
  - Columbus
  - Dayton
  - Lima
- PENNSYLVANIA:
  - Philadelphia
  - Pittsburgh
  - Reading
  - York
- SOUTH CAROLINA:
  - Charleston
- TEXAS:
  - Beaumont
  - Corpus Christi
  - Dallas-Ft. Worth
  - Galveston
  - Houston
  - San Antonio
- VIRGINIA:
  - Newport News
  - Norfolk
- WASHINGTON:
  - Seattle
  - Tacoma
- WASHINGTON, D.C.

SOURCE: Pothin 1982

THE JOB OUTLOOK FOR SKILLED WORKERS—AN UPDATED VIEW

The U.S. economy has been highly unpredictable for the past several years, and economic forecasts have been subject to frequent revisions. In this section economic forecasts that were made in August 1982 (see table 10-8) are used to project labor requirements for a number of occupations.

Table 10-8 shows that the economy is expected to recover over the next several years, with prices and unemployment coming down gradually. These projections were used to drive the Defense Interindustry Forecasting System (see the Appendix).

TABLE 10-8

ECONOMIC ASSUMPTIONS FOR PROJECTIONS OF LABOR REQUIREMENTS—UNEMPLOYMENT FALLS STEADILY—INFLATION REMAINS IN SINGLE DIGITS

	Annual Rates of Change						
	1981	1982	1983	1984	1985	1986	1987
Real Gross National Product (%)	1.9	-1.2	2.9	4.2	4.4	3.5	3.0
Consumer Price Index (%)	10.3	6.3	6.8	6.5	7.4	7.4	6.9
Unemployment Rate (%)	7.6	9.2	8.8	8.0	7.2	6.8	6.6

SOURCE: Data Resources, Inc.

A sample of the output from the model is shown in table 10-9. The bottom line indicates that there were a total of 27,600 employed postsecondary teachers of vocational education, of which 900 were employed in defense-related industries. In 1987 there will be 31,200 such teachers employed, with about 1,000 of them in defense-related industries. This represents a 2.8 percent per year average annual employment growth rate in defense-related industries and a 2.1 percent growth rate for all industries. For comparative purposes, total nonagricultural employment is expected to grow by 2.4 percent annually over the same period.

TABLE 10-9

TEACHERS, VOCATIONAL EDUCATION—FEW NEW JOBS WILL BE CREATED BY DEFENSE SPENDING

	Employment (thousands)														Average Annual % Growth 1981-1987	
	1981		1982		1983		1984		1985		1986		1987			
INDUSTRY	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total
Air Transportation	0.1	3.6	0.1	3.6	0.2	3.8	0.2	4.0	0.2	4.2	0.2	4.3	0.2	4.3	7.5	3.2
Education Services	0.0	6.1	0.1	6.1	0.1	6.1	0.1	6.2	0.1	6.4	0.1	6.5	0.1	6.7	4.9	1.6
Social Services, NEC	0.7	10.6	0.7	10.5	0.7	10.6	0.7	10.7	0.7	10.8	0.7	10.9	0.7	11.0	0.4	0.6
Nonprofit Organizations and Miscellaneous Services	0.0	7.4	0.0	7.7	0.1	8.0	0.1	8.3	0.1	8.6	0.1	8.9	0.1	9.3	13.1	3.7
TOTAL, ALL INDUSTRIES	0.9	27.6	0.7	27.8	1.0	28.4	1.0	29.1	1.0	30.0	1.0	30.6	1.0	31.2	2.8	2.1

SOURCE: Defense Interindustry Forecasting System

Table 10-9 also illustrates the difficult problems that arise when making economic forecasts. The category "Teachers, Vocational Education" is defined by the Bureau of Labor Statistics to be "Teachers of vocational and/or occupational subjects at the postsecondary level (but at less than the baccalaureate) to students who have graduated or left high school. . . ." This seemingly straightforward definition has been difficult to quantify. According to Carey (1981), there were about 26,000 persons employed in this category in 1978. Golladay and Wulfsberg (1981, p. 118), however, estimated that there were 56,058 "full-time equivalent" teachers employed in a similar category in 1978. The Bureau of Labor Statistics conducted a survey in 1980 and concluded that the employment level then was actually 43,204. The important point is that economic projections are best used to spot broad trends, rather than to predict exact employment levels. Anyone who wonders how seriously to take the precise estimates shown on tables 10-9 through 10-16 may well ponder the fact that analysts cannot even agree on what the correct figures were several years ago.

Projections for other types of teachers appear in table 10-10. There will be modest increases in defense-induced employment in all categories through 1987, in spite of sluggish demand overall. Total demand for college and university teachers will actually decrease.

Table 10-11, concerning social scientists, and table 10-12, on health technologists and technicians, show a frequently recurring pattern. The overall demand for economists, psychologists, and sociologists will grow at about or more than the national average of 2.4 percent per year, but the defense-induced component will grow at a much higher percentage rate. At the same time, the absolute number of people in defense-related employment will remain a small percentage of the total.

On the other hand, tables 10-13 and 10-14 show areas where potential problems could easily occur. The demand for engineers and electrical and electronics technicians is expected to be large in both defense and nondefense categories, in both percentage and absolute terms. Of special interest are the comparative totals for 1981, 1982, and 1987. The 1981-82 recession has caused total employment in these categories to be flat. Increased defense spending and an improving economy, however, will cause defense-related demand to double by 1987. Since it takes several years to train engineers, severe shortages could develop very quickly and be very long lasting. At the same time, the job prospects for electrical and electronics technicians may be even better than they currently appear to be, since employers will be forced

TABLE 10-10

SOME DEFENSE RELATED TEACHING JOBS WILL GROW MODERATELY WITHIN A POOR LABOR MARKET

TEACHERS, ADULT EDUCATION

	Employment (thousands)														Average Annual % Growth	
	1981		1982		1983		1984		1985		1986		1987		1981-1987	
INDUSTRY	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total
Office, Computing, and Accounting Machines	0.0	1.2	0.1	1.2	0.1	1.3	0.1	1.3	0.1	1.3	0.1	1.4	0.1	1.4	7.1	1.7
Communication Equipment	0.4	1.1	0.4	1.1	0.5	1.2	0.6	1.3	0.6	1.4	0.7	1.5	0.7	1.6	10.3	5.5
Wholesale Trade	0.0	1.4	0.0	1.4	0.0	1.4	0.0	1.5	0.0	1.6	0.1	1.6	0.1	1.6	11.8	3.3
Retail Trade	0.0	1.3	0.0	1.3	0.0	1.4	0.0	1.4	0.0	1.5	0.0	1.5	0.0	1.5	12.9	2.9
Miscellaneous Business Services	0.1	1.3	0.1	1.4	0.1	1.5	0.1	1.7	0.1	1.8	0.1	2.0	0.1	2.1	14.3	7.7
Health Services, NEC	0.0	0.8	0.0	0.8	0.0	0.9	0.0	0.9	0.0	1.0	0.0	1.1	0.0	1.2	5.4	6.9
Educational Services	0.4	58.5	0.5	58.3	0.5	58.9	0.5	59.8	0.6	61.1	0.6	62.5	0.6	64.1	4.8	1.6
Social Services, NEC	0.6	8.9	0.6	8.9	0.6	9.0	0.6	9.1	0.6	9.2	0.6	9.4	0.6	9.5	0.7	1.0
Nonprofit Organizations and Miscellaneous Services, NEC	0.0	5.4	0.0	5.5	0.0	5.6	0.0	5.8	0.1	6.0	0.1	6.2	0.1	6.4	12.1	2.8
Government	0.0	20.3	0.0	19.9	0.0	19.9	0.0	19.9	0.0	20.1	0.0	20.2	0.0	20.5	8.8	0.1
Self-Employed	0.1	4.1	0.1	4.1	0.1	4.2	0.1	4.2	0.1	4.3	0.1	4.4	0.1	4.5	7.4	1.6
TOTAL, ALL INDUSTRIES	2.4	110.6	2.5	110.2	2.8	111.8	3.0	113.9	3.3	116.6	3.5	119.2	3.6	122.0	7.4	1.6
TEACHERS, COLLEGE AND UNIVERSITY																
Educational Services	3.3	451.8	3.7	441.3	3.7	436.5	3.8	434.5	4.0	434.8	4.0	435.5	3.9	437.3	2.6	-0.5
Government	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	8.7	0.1
Self-Employed	1.1	155.5	1.3	151.9	1.3	150.2	1.3	149.5	1.4	149.6	1.4	149.9	1.3	150.5	2.6	-0.5
TOTAL, ALL INDUSTRIES	4.5	608.3	4.9	594.2	5.0	587.8	5.2	585.1	5.4	585.4	5.4	586.4	5.2	588.9	2.6	-0.5
TEACHERS, NEC																
Amusements and Recreation Services	0.1	9.3	0.1	9.2	0.1	9.1	0.1	9.2	0.1	9.4	0.1	9.5	0.1	9.7	7.2	0.7
Hospitals	0.1	13.6	0.1	14.0	0.1	14.6	0.1	15.1	0.1	15.7	0.1	16.4	0.1	17.1	2.6	3.9
Health Services, NEC	0.0	1.3	0.0	1.4	0.0	1.4	0.0	1.5	0.0	1.7	0.0	1.8	0.0	1.9	5.4	6.9
Educational Services	22.6	3,066.6	25.3	3,040.2	25.8	3,052.7	27.3	3,085.0	28.8	3,134.1	29.3	3,187.9	28.9	3,251.5	4.2	1.0
Social Services, NEC	6.5	105.6	6.9	105.7	7.0	107.2	7.1	109.3	7.3	111.6	7.3	113.9	7.0	115.7	1.2	1.5
Nonprofit Organizations and Miscellaneous Services, NEC	0.1	19.2	0.1	19.5	0.1	20.0	0.2	20.5	0.2	21.0	0.2	21.4	0.2	22.0	11.5	2.3
Government	0.0	8.3	0.0	8.2	0.0	8.2	0.0	8.2	0.0	8.2	0.0	8.3	0.0	8.4	8.7	0.1
Self-Employed	0.6	69.6	0.7	69.0	0.7	69.4	0.7	70.1	0.8	71.3	0.8	72.5	0.8	74.0	3.6	1.0
TOTAL, ALL INDUSTRIES	30.0	3,294.8	33.2	3,268.6	33.9	3,284.0	35.5	3,320.5	37.3	3,374.6	37.8	3,433.5	37.2	3,502.0	3.6	1.0

SOURCE: Defense Interindustry Forecasting System

TABLE 10-11

SOCIAL SCIENTISTS WILL REMAIN CONCENTRATED IN NONDEFENSE INDUSTRIES

INDUSTRY	1981		1982		1983		1984		1985		1986		1987		Average Annual % Growth 1981-1987	
	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total
ECONOMISTS, FINANCIAL ANALYSTS — Employment (thousands)																
Crude Petroleum and Natural Gas	0.0	1.0	0.0	1.0	0.0	1.1	0.0	1.0	0.1	1.0	0.1	1.0	0.1	1.0	6.7	1.1
Utilities and Sanitary Services	0.0	2.4	0.1	2.5	0.1	2.6	0.1	2.7	0.1	2.9	0.1	3.0	0.1	3.1	11.6	4.1
Banking	0.0	4.0	0.0	4.1	0.0	4.3	0.1	4.6	0.1	4.9	0.1	5.2	0.1	5.5	14.8	5.7
Credit Agencies & Security Brokers	0.1	6.3	0.1	6.6	0.1	6.8	0.1	7.1	0.1	7.4	0.1	7.7	0.1	7.9	12.0	3.8
Insurance Carriers and Agents	0.0	1.8	0.0	1.8	0.0	1.9	0.0	1.9	0.0	2.0	0.0	2.0	0.0	2.1	9.3	2.2
Miscellaneous Business Services	0.2	4.2	0.2	4.3	0.2	4.5	0.3	4.7	0.3	5.0	0.3	5.3	0.4	5.5	10.8	4.4
Educational Services	0.0	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	2.4	3.5	0.3
Nonprofit Organizations and Miscellaneous Services, NEC	0.0	1.0	0.0	1.1	0.0	1.3	0.0	1.4	0.0	1.5	0.0	1.7	0.0	1.8	19.9	10.0
Government	0.0	14.2	0.0	14.5	0.0	15.1	0.0	15.6	0.0	16.3	0.0	16.9	0.0	17.6	12.6	3.6
Self-Employed	0.1	4.5	0.1	4.6	0.1	4.8	0.1	5.0	0.1	5.2	0.1	5.4	0.2	5.6	11.6	3.9
TOTAL, ALL INDUSTRIES	0.9	45.8	0.9	46.6	1.1	48.7	1.2	50.8	1.4	53.2	1.5	55.4	1.6	57.5	11.6	3.9
PSYCHOLOGISTS																
Miscellaneous Business Services	0.1	1.7	0.1	1.7	0.1	1.8	0.1	1.8	0.1	1.9	0.1	1.9	0.1	2.0	8.1	1.9
Hospitals	0.0	9.0	0.0	9.3	0.0	9.8	0.0	10.2	0.0	10.7	0.0	11.3	0.0	11.9	3.5	4.8
Health Services, NEC	0.0	8.1	0.0	8.6	0.0	9.1	0.0	9.8	0.0	10.5	0.0	11.4	0.0	12.3	5.6	7.2
Educational Services	0.3	37.6	0.3	37.3	0.3	37.4	0.3	37.8	0.4	38.4	0.4	39.0	0.4	39.8	4.1	0.9
Social Services, NEC	0.2	3.9	0.3	4.0	0.3	4.1	0.3	4.2	0.3	4.4	0.3	4.5	0.3	4.6	2.5	2.7
Nonprofit Organizations and Miscellaneous Services, NEC	0.0	0.9	0.0	0.9	0.0	1.0	0.0	1.1	0.0	1.1	0.0	1.2	0.0	1.3	16.6	7.0
Government	0.0	9.8	0.0	9.7	0.0	9.8	0.0	10.0	0.0	10.1	0.0	10.3	0.0	10.5	10.0	1.2
Self-Employed	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.1	0.0	2.1	0.0	2.2	0.0	2.3	5.5	2.5
TOTAL, ALL INDUSTRIES	0.8	74.3	0.9	74.8	1.0	76.4	1.0	78.4	1.1	80.8	1.1	83.4	1.2	86.2	5.3	2.5
SOCIOLOGISTS, URBAN/REGIONAL PLANNERS																
Miscellaneous Business Services	0.1	2.4	0.1	2.4	0.1	2.5	0.2	2.6	0.2	2.7	0.2	2.8	0.2	2.9	9.1	2.8
Educational Services	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	3.5	0.3
Nonprofit Organizations and Miscellaneous Services, NEC	0.0	1.9	0.0	2.0	0.0	2.2	0.0	2.3	0.0	2.5	0.0	2.6	0.0	2.8	16.1	6.5
Government	0.0	22.3	0.0	22.2	0.0	22.6	0.0	23.0	0.0	23.5	0.0	24.1	0.0	24.7	10.5	1.7
Self-Employed	0.0	6.7	0.0	6.7	0.1	6.8	0.1	7.0	0.1	7.2	0.1	7.4	0.1	7.6	8.5	2.2
TOTAL, ALL INDUSTRIES	0.2	35.7	0.2	35.8	0.3	36.5	0.3	37.4	0.3	38.4	0.4	39.3	0.4	40.6	8.5	2.2

SOURCE: Defense Interindustry Forecasting System

TABLE 10-12

HEALTH TECHNOLOGISTS AND TECHNICIANS—OVER 99 PERCENT OF THE JOBS ARE IN NONDEFENSE-RELATED INDUSTRIES

	Employment (thousands)														Average Annual % Growth 1981-1987	
	1981		1982		1983		1984		1985		1986		1987			
INDUSTRY	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total
Medical and Dental Instruments and Supplies	0.1	2.1	0.1	2.1	0.1	2.2	0.1	2.1	0.1	2.2	0.1	2.3	0.1	2.3	7.9	1.9
Local and Interurban Transit	0.0	2.4	0.0	2.4	0.1	2.5	0.1	2.7	0.1	2.8	0.1	2.9	0.1	3.0	13.4	4.1
Retail Trade	0.0	4.4	0.0	4.4	0.0	4.5	0.0	4.5	0.0	4.6	0.0	4.5	0.0	4.5	10.0	0.3
Insurance Carriers and Agents	0.0	2.4	0.0	2.4	0.0	2.5	0.0	2.6	0.0	2.7	0.0	2.8	0.0	2.8	10.0	2.8
Miscellaneous Business Services	1.4	30.9	1.6	32.2	1.9	34.6	2.2	37.4	2.5	40.5	2.8	43.2	3.1	45.8	13.3	6.7
Hospitals	2.9	711.3	3.3	728.9	3.3	756.5	3.4	781.2	3.5	809.2	3.5	843.2	3.3	877.3	2.3	3.6
Health Services, NEC	1.1	321.1	1.2	332.1	1.2	344.7	1.3	361.4	1.3	381.4	1.4	306.5	1.3	430.4	3.5	5.0
Educational Services	0.3	39.5	0.3	38.9	0.3	38.8	0.3	39.0	0.4	39.3	0.4	39.8	0.4	40.3	3.5	0.3
Social Services, NEC	1.0	16.8	1.1	17.2	1.2	17.8	1.2	18.4	1.3	19.1	1.3	19.8	1.2	20.3	2.9	3.2
Nonprofit Organizations and Miscellaneous Services, NEC	0.0	3.3	0.0	3.4	0.0	3.6	0.0	3.7	0.0	3.9	0.0	4.1	0.0	4.2	13.7	4.3
Private Households	0.0	15.6	0.0	15.8	0.0	15.9	0.0	16.0	0.0	16.2	0.0	16.3	0.0	16.5	—	0.9
Government	0.0	79.3	0.0	78.0	0.0	78.3	0.0	78.7	0.0	79.4	0.0	80.3	0.0	81.4	9.1	0.4
Self-Employed	1.0	163.4	1.1	167.1	1.2	173.0	1.3	179.1	1.4	186.2	1.4	194.7	1.3	203.1	5.9	3.7
TOTAL, ALL INDUSTRIES	8.9	1,402.8	9.9	1,435.1	10.4	1,485.3	11.1	1,537.9	11.8	1,599.0	12.4	1,671.9	12.6	1,743.8	5.9	3.7

SOURCE: Defense Interindustry Forecasting System

TABLE 10-13

DEFENSE-RELATED DEMAND FOR MANY TYPES OF ENGINEERS WILL DOUBLE BY 1987

AERO-ASTRONAUTIC ENGINEERS

	Employment (thousands)														*Average Annual %Growth 1981-1987	
	1981		1982		1983		1984		1985		1986		1987			
INDUSTRY	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total
Ordnance and Accessories	18.4	25.5	20.7	27.8	24.8	32.3	29.6	37.1	34.7	42.5	40.1	48.4	45.2	53.8	16.2	13.3
Communication Equipment	0.7	2.0	0.8	2.0	0.9	2.1	1.0	2.3	1.1	2.4	1.2	2.6	1.3	2.7	10.3	5.5
Aircraft and Parts	10.3	26.7	10.7	25.4	12.7	28.6	15.2	33.1	17.9	37.3	20.5	41.2	22.8	44.6	14.3	8.9
Air Transportation	0.0	1.1	0.0	1.2	0.0	1.2	0.1	1.3	0.1	1.3	0.1	1.3	0.1	1.3	7.7	2.5
Miscellaneous Business Services	0.2	4.4	0.2	4.5	0.3	4.7	0.3	5.0	0.3	5.3	0.4	5.6	0.4	5.8	11.1	4.7
Miscellaneous Professional Services, NEC	0.0	1.4	0.0	1.4	0.1	1.4	0.1	1.5	0.1	1.6	0.1	1.6	0.1	1.7	12.3	3.5
Government	0.0	9.1	0.0	9.1	0.0	9.2	0.0	9.3	0.0	9.4	0.0	9.6	0.0	9.8	10.0	1.3
TOTAL, ALL INDUSTRIES	27.4	66.7	30.0	67.7	35.8	75.3	42.6	84.7	49.9	94.5	57.5	103.9	64.4	112.7	15.3	9.1
ELECTRICAL ENGINEERS																
Crude Petroleum and Natural Gas	0.1	1.8	0.1	1.8	0.1	2.0	0.1	1.9	0.1	1.9	0.1	1.9	0.1	1.9	6.4	0.8
New Construction	0.0	5.6	0.0	5.4	0.1	5.9	0.1	6.3	0.1	6.8	0.1	7.0	0.1	7.1	13.2	4.2
Maintenance & Repair Construction	0.1	2.2	0.1	2.2	0.1	2.3	0.1	2.3	0.1	2.3	0.1	2.4	0.1	2.4	6.9	1.2
Ordnance and Accessories	5.7	7.9	6.3	8.5	7.5	9.7	8.8	11.1	10.2	12.5	11.7	14.1	13.1	15.6	14.9	12.0
Industrial Organic and Inorganic Chemicals	0.0	1.5	0.1	1.5	0.1	1.6	0.1	1.7	0.1	1.7	0.1	1.7	0.1	1.7	8.5	1.9
Nonferrous Rolling and Drawing	0.1	1.1	0.1	1.1	0.1	1.1	0.1	1.2	0.1	1.2	0.1	1.3	0.1	1.3	11.8	2.9
Construction and Related Machinery and Equipment	0.0	1.5	0.1	1.4	0.1	1.5	0.1	1.6	0.1	1.7	0.1	1.8	0.1	1.8	10.0	3.3
Metalworking Machinery & Equipment	0.1	1.8	0.1	1.6	0.1	1.7	0.1	1.9	0.2	2.0	0.2	2.1	0.2	2.1	11.8	2.8
Special Industry Machinery except Metalworking	0.0	1.1	0.0	1.0	0.0	1.0	0.0	1.1	0.0	1.2	0.0	1.2	0.0	1.2	11.1	2.1
General Industrial Machinery and Equipment	0.1	1.4	0.1	1.3	0.1	1.3	0.1	1.4	0.1	1.5	0.1	1.5	0.1	1.5	9.5	1.7
Office, Computing, and Accounting Machines	1.3	33.2	1.5	32.7	1.6	35.4	1.8	37.1	1.9	38.2	2.1	39.4	2.2	40.5	8.8	3.3
Electric Transmission and Distribution Equipment	0.1	2.5	0.1	2.3	0.1	2.4	0.1	2.6	0.1	2.7	0.1	2.7	0.1	2.8	10.3	1.9
Electrical Industrial Apparatus	0.2	5.8	0.3	5.5	0.3	5.8	0.3	6.2	0.4	6.5	0.4	6.7	0.5	6.8	11.3	2.6
Electrical Lighting and Wiring Equipment	0.1	1.7	0.1	1.7	0.1	1.7	0.1	1.8	0.1	1.9	0.1	1.9	0.1	2.0	11.7	2.5
Radio & TV Receiving Equipment	0.0	1.7	0.0	1.6	0.0	1.8	0.0	1.9	0.0	2.1	0.0	2.2	0.0	2.2	15.6	4.6
Communication Equipment	23.2	63.8	25.5	65.6	29.2	70.7	33.5	77.8	38.0	84.7	42.1	90.2	45.6	96.0	11.9	7.0
Electronic Components and Accessories	3.6	22.6	3.8	21.6	4.5	23.9	5.3	26.4	6.2	29.1	7.0	31.3	7.7	33.2	13.6	6.6
Miscellaneous Electrical Equipment and Supplies	0.0	1.5	0.0	1.4	0.0	1.5	0.1	1.5	0.1	1.6	0.1	1.6	0.1	1.6	10.5	0.9
Aircraft and Parts	1.7	4.5	1.7	4.1	2.0	4.4	2.3	4.9	2.6	5.4	2.8	5.7	3.1	6.0	9.9	4.8
Engineering and Scientific Instruments	2.6	7.9	2.7	7.9	3.0	8.4	3.3	9.0	3.6	9.7	3.8	10.3	4.1	11.0	7.9	5.7
Measuring and																

Controlling Instruments	0.6	9.8	0.6	9.8	0.7	10.6	0.8	11.7	0.9	12.8	1.0	13.5	1.1	14.1	12.6	6.2
Optical Instruments and Lenses	0.1	1.7	0.1	1.5	0.1	1.6	0.1	1.7	0.1	1.8	0.1	1.9	0.1	2.9	8.7	3.1
Medical and Dental Instruments and Supplies	0.0	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0	1.0	0.0	1.0	0.0	1.0	7.9	1.9
Photographic Equipment and Supplies	0.1	2.4	0.1	2.4	0.1	2.5	0.1	2.6	0.1	2.7	0.1	2.9	0.1	3.0	6.8	3.5
Communications, except Radio and TV	0.5	20.1	0.5	20.9	0.6	22.2	0.6	23.8	0.7	25.1	0.7	26.5	0.8	27.7	9.0	5.4
Radio and TV Broadcasting	0.2	8.9	0.2	9.2	0.2	9.7	0.2	10.2	0.3	10.7	0.3	11.0	0.3	11.3	12.2	4.1
Utilities & Sanitary Services	0.3	15.8	0.4	16.1	0.4	16.8	0.5	17.5	0.5	18.3	0.6	19.0	0.6	19.7	11.1	3.7
Wholesale Trade	0.2	11.6	0.3	11.6	0.3	12.3	0.4	12.9	0.4	13.4	0.5	13.8	0.5	14.2	12.0	3.5
Miscellaneous Business Services	1.2	26.0	1.4	27.0	1.6	28.9	1.8	31.1	2.1	33.6	2.3	35.8	2.5	37.8	12.9	6.4
Hospitals	0.0	0.9	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.1	0.0	1.1	0.0	1.2	2.6	3.9
Miscellaneous Professional Services, NEC	0.6	21.5	0.7	22.1	0.9	23.7	1.0	25.2	1.2	26.9	1.3	28.3	1.5	29.8	14.6	5.6
Educational Services	0.0	3.8	0.0	3.8	0.0	3.9	0.0	3.9	0.0	4.0	0.0	4.1	0.0	4.1	4.5	1.2
Nonprofit Organizations and Miscellaneous Services, NEC	0.0	1.2	0.0	1.3	0.0	1.4	0.0	1.5	0.0	1.6	0.0	1.7	0.0	1.9	17.0	7.3
Government	0.0	29.3	0.0	28.8	0.0	28.8	0.0	28.9	0.0	29.1	0.0	29.3	0.0	29.6	8.8	0.2
TOTAL, ALL INDUSTRIES	42.1	328.7	46.1	330.0	52.9	351.6	60.6	375.7	68.8	399.3	76.6	419.0	83.3	437.6	12.0	4.9

SOURCE: Defense Interindustry Forecasting System

TABLE 10-14
ELECTRICAL AND ELECTRONIC TECHNICIANS—GOOD JOB PROSPECTS IN BOTH DEFENSE AND NONDEFENSE CATEGORIES

	Employment (thousands)														Average Annual % Growth 1981-1987	
	1981		1982		1983		1984		1985		1986		1987			
INDUSTRY	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total
Crude Petroleum & Natural Gas	0.1	1.5	0.1	1.5	0.1	1.6	0.1	1.6	0.1	1.6	0.1	1.6	0.1	1.6	6.4	0.7
New Construction	0.1	9.9	0.1	9.9	0.1	10.8	0.1	11.7	0.1	12.7	0.2	13.4	0.2	13.7	14.7	5.6
Maintenance & Repair Construction	0.1	4.0	0.1	4.0	0.2	4.1	0.2	4.2	0.2	4.4	0.2	4.5	0.2	4.6	8.3	2.5
Ordnance and Accessories	4.0	5.5	4.4	5.9	5.1	6.6	6.0	7.5	6.8	8.4	7.7	9.3	8.6	10.2	13.7	10.8
Construction and Related Machinery and Equipment	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.1	0.0	1.1	0.1	1.2	0.1	1.2	10.0	3.3
Metalworking Machinery and Equipment	0.1	1.5	0.1	1.4	0.1	1.5	0.1	1.6	0.1	1.7	0.2	1.8	0.2	1.8	11.8	2.8
Special Industry Machinery except Metalworking	0.0	1.4	0.0	1.3	0.0	1.4	0.0	1.5	0.0	1.6	0.0	1.6	0.0	1.6	11.1	2.1
General Industrial Machinery and Equipment	0.1	1.4	0.1	1.3	0.1	1.3	0.1	1.4	0.1	1.5	0.1	1.5	0.1	1.5	9.4	1.7
Office, Computing, and Accounting Machines	1.4	34.7	1.5	34.4	1.7	37.5	1.9	39.4	2.1	40.8	2.2	42.2	2.3	43.5	9.3	3.8
Electric Transmission and Distribution Equipment	0.0	1.7	0.0	1.6	0.0	1.6	0.1	1.8	0.1	1.8	0.1	1.8	0.1	1.8	9.7	1.4
Electrical Industrial Apparatus	0.2	4.5	0.2	4.3	0.2	4.6	0.3	4.9	0.3	5.1	0.3	5.3	0.4	5.5	11.8	3.1
Electric Lighting and Wiring Equipment	0.0	1.1	0.0	1.0	0.0	1.1	0.0	1.2	0.1	1.2	0.1	1.2	0.1	1.2	11.7	2.4
Radio and TV Receiving Equipment	0.0	1.8	0.0	1.8	0.0	1.9	0.0	2.1	0.0	2.4	0.0	2.5	0.0	2.7	17.8	6.6
Communication Equipment	11.6	31.8	12.6	32.5	14.4	34.8	16.4	38.1	18.5	41.3	20.4	43.8	22.0	46.4	11.3	6.5
Electronic Components and Accessories	3.2	20.3	3.4	19.2	4.0	21.1	4.6	23.1	5.3	25.2	6.0	27.0	6.6	28.3	12.7	5.8
Miscellaneous Electrical Equipment and Supplies	0.0	1.4	0.0	1.3	0.0	1.4	0.0	1.4	0.1	1.4	0.1	1.5	0.1	1.5	10.5	0.9
Aircraft and Parts	1.8	4.7	1.8	4.3	2.1	4.7	2.4	5.2	2.8	5.8	3.1	6.2	3.3	6.5	10.9	5.7
Engineering and Scientific Instruments	1.5	4.6	1.6	4.6	1.7	4.8	1.8	5.1	2.0	5.4	2.1	5.7	2.2	6.0	6.7	4.5
Measuring and Controlling Instruments	0.4	7.7	0.5	7.5	0.5	8.0	0.6	8.7	0.7	9.3	0.7	9.6	0.8	9.9	10.6	4.4
Photographic Equipment & Supplies	0.1	1.7	0.1	1.7	0.1	1.7	0.1	1.8	0.1	1.9	0.1	1.9	0.1	2.0	5.6	2.4
Air Transportation	0.0	0.9	0.0	0.9	0.0	1.0	0.0	1.0	0.0	1.1	0.1	1.1	0.1	1.1	7.9	2.7
Communications, except Radio & TV	0.4	17.1	0.4	17.5	0.5	18.3	0.5	19.3	0.6	20.1	0.6	21.0	0.6	21.6	7.4	3.9
Radio and TV Broadcasting	0.3	14.6	0.3	14.5	0.3	14.9	0.3	15.2	0.4	15.5	0.4	15.4	0.4	15.4	8.8	0.9
Utilities & Sanitary Services	0.2	11.3	0.3	11.2	0.3	11.5	0.3	11.7	0.3	12.1	0.4	12.3	0.4	12.5	8.9	1.6
Wholesale Trade	1.9	90.1	2.2	90.5	2.5	96.3	2.8	101.1	3.2	105.5	3.6	109.5	3.9	112.6	12.3	3.8
Retail Trade	0.0	1.0	0.0	1.1	0.0	1.2	0.0	1.2	0.0	1.3	0.0	1.4	0.0	1.4	15.3	5.2
Miscellaneous Personal Services, NEC	0.3	20.7	0.3	21.7	0.4	23.2	0.4	24.7	0.5	26.3	0.5	27.8	0.6	29.2	14.2	5.8
Miscellaneous Business Services	1.3	27.6	1.4	28.3	1.6	30.1	1.9	32.2	2.1	34.5	2.4	36.6	2.6	38.4	12.2	5.7
Miscellaneous Professional Services, NEC	0.2	6.1	0.2	6.2	0.2	6.5	0.3	6.9	0.3	7.2	0.4	7.5	0.4	7.8	13.1	4.2
Education Services	0.0	6.4	0.1	6.3	0.1	6.3	0.1	6.3	0.1	6.4	0.1	6.4	0.1	6.5	3.5	0.3
Nonprofit Organizations and Miscellaneous Services, NEC	0.0	1.4	0.0	1.5	0.0	1.6	0.0	1.8	0.0	1.9	0.0	2.1	0.0	2.2	18.5	8.7
U.S. Postal Service	0.0	1.6	0.0	1.5	0.0	1.6	0.0	1.6	0.0	1.6	0.1	1.7	0.1	1.7	9.2	1.0
Government	0.0	31.3	0.0	30.9	0.0	31.1	0.0	31.3	0.0	31.7	0.0	32.2	0.0	32.7	9.4	0.7
TOTAL, ALL INDUSTRIES	27.1	350.4	29.5	350.3	33.7	371.1	38.3	392.1	43.3	412.4	48.0	429.4	51.9	444.4	11.4	4.0

SOURCE: Defense Interindustry Forecasting System

to rely more and more on technicians to fill jobs that remain unfilled because of a shortage of electrical engineers. Vocational schools that train electrical and electronics technicians should have few problems placing their graduates somewhere.

A different kind of situation is developing for computer programmers (table 10-15). The total demand for programmers is expected to grow at rates more than double the national average of 2.4 percent per year. Yet this is one area where widely publicized needs have led to a tremendous supply response. People can be trained to be passable computer programmers in less than a year, and a flood of new programmers who sought training during the 1981-82 recession is already causing a glut on the market (*Business Week* 1982b). There is great potential here for this to become a market with "cobweb" adjustments, with sudden wide swings between shortages and gluts.

Table 10-16, which shows the projected needs of the engines and turbines industry, illustrates yet another potential problem. Total employment actually dropped by over 10,000 workers in this industry from 1981 to 1982, and total average annual growth from 1981 to 1987 is expected to be only 0.5 percent per year. Yet turbine engines are being used increasingly in planes, ships, and even tanks. Depending upon the reliability of the new engines, there could be a sudden increase in demand for skilled technicians in this industry.

One important point to emphasize about tables 10-15 and 10-16 is that econometric models are all based on historical patterns. If something unprecedented occurs, such as an oversupply of computer programmers or a sudden shortage of turbine engine technicians, the model will no longer be valid. This holds true for all occupations and industry sectors.

TABLE 10-15

COMPUTER PROGRAMMERS—WILL SUPPLY RESPONSES CAUSE A GLUT IN A MARKET WITH SEEMINGLY INSATIABLE DEMAND?

	Employment (thousands)														Average Annual % Growth 1981-1987	
INDUSTRY	1981		1982		1983		1984		1985		1986		1987			
	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total
Crude Petroleum and Natural Gas	0.1	2.0	0.1	2.1	0.1	2.3	0.1	2.3	0.1	2.4	0.1	2.4	0.1	2.5	9.2	3.4
New Construction	0.0	1.0	0.0	1.0	0.0	1.1	0.0	1.2	0.0	1.3	0.0	1.3	0.0	1.4	14.5	5.4
Ordnance and Accessories	1.0	1.4	1.1	1.5	1.3	1.7	1.5	1.9	1.7	2.1	1.9	2.3	2.1	2.5	12.6	9.8
Industrial Organic and Inorganic Chemicals	0.0	1.1	0.0	1.1	0.0	1.2	0.0	1.2	0.0	1.3	0.1	1.3	0.1	1.3	8.2	1.7
Petroleum Refining	0.0	0.8	0.0	0.9	0.0	0.9	0.0	0.9	0.0	1.0	0.1	1.0	0.1	1.0	8.3	2.8
Construction and Related Machinery and Equipment	0.0	1.2	0.0	1.2	0.1	1.3	0.1	1.4	0.1	1.5	0.1	1.6	0.1	1.6	11.4	4.6
Office, Computing and Accounting Machines	0.8	20.9	0.9	20.4	1.0	22.0	1.1	22.9	1.2	23.5	1.3	24.1	1.3	24.7	8.3	2.8
Communication Equipment	1.4	3.8	1.5	3.9	1.8	4.3	2.1	4.8	2.4	5.3	2.7	5.7	2.9	6.1	13.4	8.5
Electronic Components and Accessories	0.3	2.0	0.3	1.9	0.4	2.2	0.5	2.4	0.6	2.7	0.6	2.9	0.7	3.1	14.6	7.5
Motor Vehicles and Equipment	0.0	1.2	0.0	1.1	0.0	1.2	0.0	1.3	0.1	1.3	0.1	1.4	0.1	1.4	17.4	2.6
Aircraft and Parts	0.9	2.4	0.9	2.2	1.1	2.5	1.3	2.8	1.5	3.2	1.7	3.4	1.9	3.7	12.7	7.4
Engineering and Scientific Instruments	0.9	2.8	0.9	2.7	1.0	2.8	1.1	2.9	1.1	3.1	1.2	3.2	1.2	3.3	5.4	3.3
Measuring & Controlling Instruments	0.1	1.0	0.1	0.9	0.1	1.0	0.1	1.1	0.1	1.1	0.1	1.2	0.1	1.2	10.0	3.8
Trucking and Warehousing	0.0	1.0	0.0	1.0	0.0	1.1	0.1	1.1	0.1	1.2	0.1	1.2	0.1	1.2	5.7	3.3
Air Transportation	0.0	1.2	0.0	1.2	0.1	1.3	0.1	1.4	0.1	1.5	0.1	1.5	0.1	1.6	9.9	4.6
Communications, Except Radio & TV	0.1	3.9	0.1	3.9	0.1	4.0	0.1	4.2	0.1	4.3	0.1	4.5	0.1	4.6	6.4	3.0
Utilities and Sanitary Services	0.1	3.6	0.1	3.6	0.1	3.7	0.1	3.8	0.1	4.0	0.1	4.1	0.1	4.1	9.4	2.1
Wholesale Trade	0.4	16.3	0.4	16.4	0.5	17.5	0.5	18.5	0.6	19.3	0.7	20.1	0.7	20.8	12.7	4.1
Retail Trade	0.0	2.8	0.0	3.0	0.0	3.2	0.0	3.3	0.0	3.5	0.0	3.6	0.0	3.7	14.8	4.7
Banking	0.1	8.3	0.1	8.7	0.1	9.2	0.1	9.8	0.1	10.6	0.2	11.3	0.2	11.9	15.4	6.2
Credit Agencies & Security Brokers	0.1	5.0	0.1	5.2	0.1	5.4	0.1	5.6	0.1	5.9	0.1	6.2	0.1	6.4	12.4	4.2
Insurance Carriers and Agencies	0.1	17.7	0.1	18.0	0.1	18.8	0.1	19.4	0.1	20.1	0.2	20.7	0.2	21.3	10.2	3.1
Miscellaneous Business Services	2.6	54.9	3.0	58.2	3.5	63.7	4.1	69.9	4.7	76.7	5.4	82.8	5.9	88.6	14.9	8.3
Hospitals	0.0	2.9	0.0	3.1	0.0	3.3	0.0	3.5	0.0	3.7	0.0	3.9	0.0	4.2	5.1	6.4
Miscellaneous Professional Services, NEC	0.2	6.6	0.2	6.9	0.3	7.4	0.3	8.0	0.4	8.6	0.4	9.1	0.5	9.6	15.5	6.4
Educational Services	0.1	19.2	0.2	20.1	0.2	21.3	0.2	22.6	0.2	24.0	0.2	25.5	0.2	27.1	9.3	5.9
Nonprofit Organizations and Miscellaneous Services, NEC	0.0	2.9	0.0	3.1	0.0	3.2	0.0	3.4	0.0	3.5	0.0	3.7	0.0	3.9	14.1	4.6
Government	0.0	20.2	0.0	20.4	0.0	21.0	0.0	21.6	0.0	22.3	0.0	23.1	0.0	23.9	11.7	2.8
TOTAL, ALL INDUSTRIES	9.8	227.4	10.8	232.2	12.4	247.5	14.2	262.9	16.1	278.7	17.9	292.9	19.5	306.3	12.1	5.1

SOURCE: Defense Interindustry Forecasting System

TABLE 10-16

ENGINES AND TURBINES—DOES THE SLOW PROJECTED GROWTH OF THIS INDUSTRY MASK POTENTIAL BOTTLENECKS?

INDUSTRY	Employment (thousands)														Average Annual % Growth 1981-1987	
	1981		1982		1983		1984		1985		1986		1987			
	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total	Defense	Total
Industrial Engineers	0.1	1.0	0.1	0.9	0.1	0.9	0.1	1.0	0.1	1.0	0.1	1.0	0.1	1.0	6.4	0.5
Mechanical Engineers	0.2	3.9	0.2	3.7	0.3	4.0	0.3	4.2	0.3	4.5	0.3	4.6	0.4	4.8	9.6	3.6
Engineers, NEC	0.1	1.4	0.1	1.2	0.1	1.3	0.1	1.3	0.1	1.3	0.1	1.3	0.1	1.3	5.0	-0.8
Drafters	0.1	1.4	0.1	1.3	0.1	1.4	0.1	1.4	0.1	1.5	0.1	1.5	0.1	1.5	6.8	0.9
Engineering and Science Technicians, NEC	0.1	1.3	0.1	1.2	0.1	1.3	0.1	1.3	0.1	1.4	0.1	1.4	0.1	1.4	7.7	1.8
Writers and Entertainers	0.1	1.4	0.1	1.3	0.1	1.4	0.1	1.4	0.1	1.5	0.1	1.5	0.1	1.5	6.4	0.5
Professional and Technical Workers, NEC	0.3	5.1	0.3	4.6	0.3	4.8	0.3	4.9	0.3	5.0	0.4	5.0	0.4	4.9	5.4	-0.4
Managers, Officials, Proprietors	0.4	7.2	0.4	6.6	0.4	7.0	0.5	7.2	0.5	7.3	0.5	7.4	0.6	7.4	6.4	0.5
Secretaries, Stenographers, Typists	0.2	3.7	0.2	3.4	0.2	3.6	0.3	3.8	0.3	3.9	0.3	4.0	0.3	4.0	7.2	1.3
Clerical Workers, NEC	0.6	10.3	0.6	9.4	0.6	9.9	0.7	10.2	0.7	10.4	0.8	10.5	0.8	10.6	6.4	0.5
Construction Crafts Workers	0.1	2.7	0.2	2.4	0.2	2.6	0.2	2.6	0.2	2.7	0.2	2.7	0.2	2.7	6.4	0.5
Mechanics, Repairers, Installers	0.2	4.2	0.2	3.8	0.3	4.0	0.3	4.1	0.3	4.2	0.3	4.3	0.3	4.3	6.4	0.5
Metalworking Crafts Workers	0.4	6.7	0.4	6.1	0.4	6.4	0.4	6.7	0.5	6.8	0.5	6.9	0.5	6.9	6.5	0.6
Crafts Workers, NEC	0.7	13.5	0.8	12.4	0.8	13.0	0.9	13.4	1.0	13.7	1.0	13.9	1.1	13.9	6.3	0.4
Assemblers	0.6	11.1	0.6	10.1	0.7	10.6	0.7	11.0	0.8	11.2	0.8	11.3	0.9	11.4	6.4	0.5
Metalworking Operatives	1.1	20.9	1.2	19.1	1.3	20.1	1.4	20.7	1.5	21.2	1.6	21.4	1.6	21.5	6.4	0.5
Transport Equipment Operatives	0.1	1.7	0.1	1.5	0.1	1.6	0.1	1.7	0.1	1.7	0.1	1.7	0.1	1.7	6.4	0.5
Operatives, NEC	0.6	10.7	0.6	9.7	0.6	10.2	0.7	10.5	0.7	10.7	0.8	10.7	0.8	10.7	5.9	0.0
Janitors and Sextons	0.1	1.6	0.1	1.5	0.1	1.6	0.1	1.6	0.1	1.6	0.1	1.7	0.1	1.7	6.4	0.5
Laborers, except Farm	0.3	5.5	0.3	4.9	0.3	5.1	0.3	5.1	0.4	5.2	0.4	5.1	0.4	5.0	4.3	-1.5
TOTAL, ALL INDUSTRIES	6.6	123.2	7.0	112.8	7.5	118.6	8.2	122.4	8.8	125.2	9.3	126.5	9.6	126.9	6.4	0.5

SOURCE: Defense Interindustry Forecasting System

WHAT SHOULD BE DONE ABOUT POTENTIAL SHORTAGES OF SKILLED LABOR? CONGRESS PROPOSED A $50 BILLION SOLUTION

One response to potential shortages of skilled labor has come from the House Committee on Banking, Finance and Urban Affairs, which has recently proposed the Defense Industrial Base Revitalization Act (U.S. House of Representatives 1982, hereafter referred to as H.R. 5540). The bill has three major components: industrial modernization and purchase price guarantees, funds for new college equipment, and state training grants.

The industrial modernization and purchase price guarantees section of the bill is targeted at the 50,000 small and medium size businesses that are primarily defense subcontractors and suppliers of goods and services. Besides price guarantees, there would be loan guarantees, direct loans, and purchase agreements including advance payments. The bill authorizes $1 billion per year from FY 1983 to FY 1987 for this purpose.

Colleges and universities could apply for the purchase of new scientific equipment. The federal government would pay from 50 to 100 percent of the cost. The bill authorizes $100 million per year for this purpose.

The bill would also provide $1.25 billion over the next five years for state training grants (H.R. 5540, Part 2, p. 17):

> H.R. 5540 authorizes the President to provide . . . support services in skills training carried out under the Defense Production Act. Support services include planning, evaluation, national training conferences, and the use of existing information systems. Many of these support services could be provided by institutions such as the National Center for Research in Vocational Education at Ohio State University.

Although H.R. 5540 currently has over fifty cosponsors, the bill has caused considerable controversy, primarily due to its potential cost. As several dissenting congressmen pointed out (H.R. 5540, Part 2, p. 59):

> The moneys authorized to be appropriated in the bill amount to a "mere" $6.75 billion, less than one percent of the present federal

> budget. But through leveraging by borrowing from the Treasury . . . the total amount involved could easily reach $50 billion over the five year life of the bill.

The Reagan administration opposes H.R. 5540. Nevertheless, there have been indications that some type of extraordinary measures may be necessary. A letter from Secretary of Defense Caspar Weinberger to Office of Management and Budget Director David Stockman stated:

> The Administration's initiatives for economic recovery will eventually foster conditions under which revitalization of the industrial sectors will occur. This will take several years and may not provide sufficient incentives for expansion of the industries which are subject to predatory pricing from unstable foreign sources and are critical to the production of national security systems. Our need for reducing our dependence on foreign industrial capabilities is urgent and will not allow us to wait. (H.R. 5540, Part 3, p. 2)

Some supporters of H.R. 5540, who are philosophically opposed to government intervention in the marketplace, emphasize the role of the private sector:

> Grant assistance is to be provided to states which qualify and which agree to provide some matching funds from both public and private sources over a five year period. . . . The need for skilled people and the need for the private sector to contribute heavily to their training are recognized as critical to this effort to stabilize and eventually revitalize the defense industrial base. (H.R. 5540, Part 2, p. 52)

The prospects for passage of H.R. 5540, or of any legislation of this type, are uncertain because of the often conflicting pressures of economics and ideology.

CONCLUSIONS

It is a near certainty that there will be some production bottlenecks and spot shortages of skilled labor over the next several years, due in part to the defense buildup. It is not as clear at this point precisely when and where these shortages will occur, or what should be done about them.

For vocational educators who are providing career counseling for students, a good place to start would be to ask students where they eventually want to live. If they would be happy living in one of the areas listed in table 10-7, then their prospects of finding a job in a defense-related industry will be greatly enhanced.

Since there are great uncertainties in the job prospects in a number of fields, educators would greatly help their students by providing them with flexibility. For example, one of the most promising careers for a young person with technical ability is that of an electronics technician who can repair sophisticated computer communications equipment (see top lines of tables 10-3, 10-5, and 10-6). Training such individuals is an ideal role for vocational educators. These students require specialized training but not graduate degrees, and they will be able to move freely between three critical fields: electronics, computers and C^3 (command, control, and communications).

Educators can also help both their students and the national economy by training more people in occupations that will almost surely be needed in great numbers but which require skills that may take years to learn, such as tool and die makers, electrical and electronics technicians, and machinists. In contrast, a field such as computer programming will continue to grow rapidly, but entry-level skills can be learned quite easily and the labor market has already shown that supply responses can quickly eliminate any temporary shortages.

Educators also may ask themselves what role they want the government to play in alleviating shortages of skilled labor. If they are convinced that governmental aid is necessary over the next several years, they might encourage Congress to pass the necessary legislation. On the other hand, if vocational educators are oversubsidized by the government, there could eventually be an oversupply of them, and teachers would then find themselves the victims of the same type of glut that they have been helping their students try to avoid.

It will be easier to make informed decisions about what should be done regarding shortages of skilled labor when all of the studies described in this chapter have been completed. Nevertheless, people's opinions of the appropriate actions to be taken depend not only upon economic criteria, but also upon such political considerations as the view of the "correct" role of government in a democratic society. Thus, even if there were complete agreement on when and where skilled labor shortages would most likely appear, the question of exactly how to deal with such shortages would be difficult to resolve.

APPENDIX

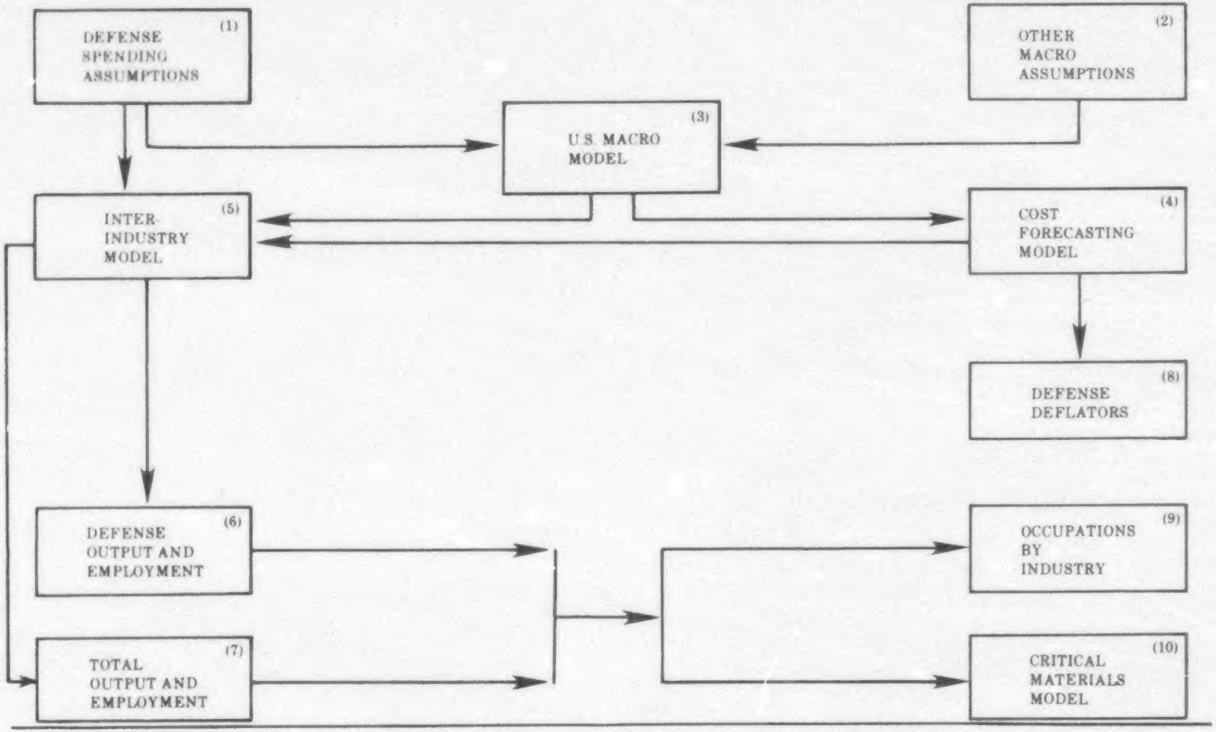
The Defense Economic Impact Modeling System (DEIMS)

The Department of Defense developed the Defense Economic Impact Modeling System (DEIMS) to serve three basic purposes: to analyze the economic impact of defense expenditures on the United States economy; to provide planning information on defense requirements to private sector firms to encourage companies to provide additional capacity where needed; and to allow the Department of Defense to analyze the impact of alternative defense budgets on key industrial sectors, skilled labor categories, and raw material requirements (Blond 1982).

DEIMS was jointly developed by the Department of Defense and Data Resources, Inc. (DRI). DRI sells a commercial version of DEIMS under the name Defense Interindustry Forecasting System.

A simplified diagram of the system appears in figure 10-1. Defense spending and other macroeconomic assumptions (boxes 1 and 2) are used to drive the DRI U.S. macromodel (box 3), which is a large-scale econometric model used for forecasting. The output of the DRI model is used to project costs and defense-induced inflation (boxes 4 and 8) and is also used to drive the interindustry model (box 5). Boxes 5, 6, and 7 represent a 400-sector, commodity-based input-output model that is used to project defense- and nondefense-related output and employment. Box 9 is an occupations-by-industry model that projects requirements for 161 different categories of skilled labor. Finally, box 10 represents a model for projecting the requirements of seventy-two different types of strategic materials.

Users may provide their own assumptions in boxes 1 and 2 to drive DRI's Defense Interindustry Forecasting System. There are a number of different types of reports and formats that may be produced. Alternatively, the Defense Department developers of DEIMS regularly update their own industry, commodity, and occupational outlooks, which they supply to interested persons. Further information about DEIMS may be obtained from the Defense Industrial Resources Support Office, Office of the Undersecretary of Defense for Research and Engineering, Two Skyline Place, Suite 1406, 5203 Leesburg Pike, Falls Church, Virginia 22041.


DEFENSE SPENDING ASSUMPTIONS (1)
OTHER MACRO ASSUMPTIONS (2)
U.S. MACRO MODEL (3)
COST FORECASTING MODEL (4)
INTER-INDUSTRY MODEL (5)
DEFENSE OUTPUT AND EMPLOYMENT (6)
TOTAL OUTPUT AND EMPLOYMENT (7)
DEFENSE DEFLATORS (8)
OCCUPATIONS BY INDUSTRY (9)
CRITICAL MATERIALS MODEL (10)

SOURCE: Data Resources, Inc. (Unpublished information received in 1982).

Figure 10-1. Simplified diagram of the Defense Interindustry Forecasting System

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RICHARD V.L. COOPER

11

Employment Effects of the Defense Budget: Reactor Comments

The employment effects of defense spending have long been of interest to economists, defense analysts, policymakers, and policitians. In years past, proponents of various defense programs such as the construction of the B-1 bombers were often quick to cite the employment "multiplier" effects of the specific program in contention. The argument put forth by these proponents was that spending on the particular program would generate spillover effects in other industries and sectors of the economy, thus generating additional jobs beyond those created by the specific program. Opponents of the programs were just as quick to dispute these claims, or at least to dispute the magnitude of the employment multiplier effect cited by proponents.

More recently, the debate has taken a different turn. As the president has called for a substantial build-up in defense spending, concerns have been expressed by some that this build-up will create "bottlenecks" in the U.S. economy, among them employment bottlenecks. The specific concern is that competition from the defense industry for individuals in certain critical occupations (such as engineers and machinists) will lead to shortages of skilled workers in these occupations in the civilian sector.

Unfortunately, there are relatively little data or few analyses with which to judge the validity of these assertions regarding the impact of defense spending on employment. There is, however, an emerging literature in this area, which is very ably described by Charles Dale.

Dale properly notes some of the problems that have historically plagued this literature. Perhaps most important, Dale shows that actual behavior in the marketplace is much more complicated than the recent policy debate. This debate about potential employment bottlenecks paints on overly simplistic picture of the effects of defense spending, enough so that misleading conclusions can be drawn.

As an illustration, Dale points to the shortage of computer technicians a few years past. The market responded to this shortage with increased wages for computer technicians and with computer technician training in vocational schools. The result was an increase in the numbers of computer technicians, so that the one-time shortage has been substantially reduced, if not eliminated altogether. Dale further notes that there are not even common definitions for many occupations, so that we cannot get good measures of "shortages."

Overall, I believe Dale does a good job of (1) describing past and ongoing research and (2) assessing the results of past research.

My only point of disagreement centers on Dale's statement, "It will be easier to make informed decisions . . . when all the studies described in this paper have been completed." I am not sure that this is the case, for I believe that much of the ongoing research is misdirected and is unlikely to tell us much more than we now know.

At the core of the problem is a "bean counting mentality." The past and ongoing literature has a tendency to define shortages in very narrow terms; that is, as the difference between the requirements for a specific job classification and the number of individuals in that classification.

This approach presents a distorted view in two different respects. First (as noted by Dale), it fails to recognize the response of the market to "shortages." A shortage can only persist if there are constraints on prices or wages. One only has to recall the gasoline lines of 1973 and 1979 to recognize that shortages can exist, but that particular shortage happened primarily because prices were not allowed to rise to their market clearing level. When prices or wages are allowed to so rise, shortages disappear.

Second, much of the literature fails to recognize the possibility of substitution; rather, it presumes a fixed coefficient production function. With few exceptions, though, different factors of production have substitutes. (An illustration of an exception is the number of wheels required for a bicycle—two, no more and no less.) As the price of one input rises, it pays to substitute other, less expensive substitutes.

This is not to imply that "shortages" are unimportant, for there are plenty of instances in the past where temporary shortages have created very real disruptions of the economy. Rather, it is to say that most past and ongoing research appears to be focused on the wrong issues.

I would like to suggest what I believe would be a more productive line of research. First, it seems clear that more research is needed on the responsiveness of the market—that is, on determining what the lags are. For some occupations (e.g., computer programmers) the lags are likely to be relatively brief. Wages can rise quickly, and training time is relatively short. For others, such as physicians, the response time is much longer, either because of the "stickiness" of wages or the length of training time.

Second, research is needed to determine the substitutability among occupations. For occupations with ready substitutes, so-called shortages may be relatively unimportant. For others with less ready substitutes, these shortages can be much more damaging.

In conclusion, the employment effects of defense spending (e.g., employment bottlenecks) deserve careful study. However, I believe that research ought to be focused on the key questions of how rapidly the market responds with respect to labor supply and how substitutable various occupations are (both labor-labor and labor-capital substitutions) with respect to labor demand. In this regard, it is worth noting that there have been substantial variations in defense spending in the past. These past variations could prove a rich source of information for investigating these questions.

State and Local Adjustments to Changing Labor Market Demands

DAVID W. STEVENS

12

The States' Human Resource Development Role in Response to Potential Employment Growth and Emerging Occupations

INTRODUCTION

Three topics, related to the general conference theme of responsiveness to changing labor market demands, are examined in this chapter. They are the following:

- What options are available for state and local consideration with respect to selecting a human resource development role?
- What barriers have been or might be encountered in acting upon each of these alternatives?
- What exemplary actions to date warrant attention by others who have not yet decided upon a desired course of action?

At the outset, I would like to make two points that are central to the topic of this chapter, which are not apparent from the title. These points reflect a reemergence of concern about downside secular imbalances. The first is that potential employment growth must be complemented by actual employment decline, as a driving force behind state and local responses to changing labor market events. The second is that one must be aware of the importance of vanishing occupations, as a complement to the traditional expression of interest in new and emerging occupations.

This chapter is divided into five parts. The first section explores the basic menu from which state and local choices must be drawn. The second develops the barriers that impede selection of particular state and local strategies. The third section provides exemplary cases that have been identified as models for others to emulate. The fourth addresses the relevance of these historical events for future guidance. The final section presents recommendations for future consideration by policymakers.

POTENTIAL STATE AND LOCAL ROLES

I have been asked to address both state and local roles in responding to changing labor market demands. For convenience only, I will focus on the state as the basic unit of analysis throughout the paper, recognizing that this masks many aspects of intergovernmental relations. However, with a few notable exceptions, the state-local and the federal-state relationships are sufficiently comparable for our purposes that this expositional simplification should be acceptable to most readers.

The following theme underlies the approach that is taken in the remainder of the chapter. Actions were initiated by a few states, as much as twenty-five years ago, to secure a competitive edge over other states in attracting new employment opportunities. These actions have stimulated defensive reactions by some of the other states, resulting in a fundamental realignment of the extent to which current production costs are borne by persons other than the ultimate consumers of the goods and services produced. (This realignment of cost sharing is frequently justified, of course, by appealing to the additional tax revenues that are generated thereby.) In addition, the eligibility criteria to receive state monies for training purposes sometimes give newcomers a cost advantage over companies in the locale for some time. This advantage may promote mobility in ways that, at least in principle, would be judged unfortunate by some observers.

Among the questions that must be answered at the state level, either explicitly or by default, are the following:

- How much fine tuning should be practiced to offer appropriate training, through what institutional auspices, and with what geographic boundaries in mind?

- What complementary actions, including tax incentives and/or direct subsidies, should be offered to strengthen the relative attractiveness of the state's training efforts?

Each of these questions can be decomposed into a series of more limited inquires. The definition of training appropriateness requires prior resolution of a host of issues related to the role of skill embodiment in hiring, retention, and promotion decisions. The range of institutional auspices might be defined to include both secondary and postsecondary, public and private, nonprofit and for-profit, classroom and on-the-job, sustaining and ad hoc, or any combination of these. Geographic boundaries might be defined with regard to serving a designated employer constituency, a specified potential student population, or some combination of these and perhaps other interested parties. Many of these issues are covered in the other chapters of this volume. So, I am focusing on a narrow range of forces that have received relatively little attention to date.

Consider the following problem, which plays havoc with attempts to fine tune training investments to emerging labor market imbalances:

> Rather than growing along a steady path, firms "pulsate" around a longer-term secular trend. In fact, recent research shows that companies with the largest *gains* during 1969-72 had the highest odds of *declining* from 1972-74. The companies "tended to overextend in one period and pay a price for it. Conversely, the companies with the largest *declines* between 1969 and 1972 had the greatest chances of experiencing *a big gain* in the next period . . . along with an above-average chance of dying." (U.S. Department of Commerce 1982, p. 84)*

This phenomenon indicates the time dependence of state human resource investment decisions: the availability of public cost sharing encourages overextension, which affects both the frequency and the amplitude of the pulsations that are observed. Part of the price that is paid for overextension is borne by the state's taxpayers and by those trainees who lose their jobs during the subsequent declines in employment. The determination of organizational eligibility to receive public training subsidies should reflect this pulsation phenomenon.

Next, consider the following assertion:

***The State of Small Business: A Report of the President* cites David Birch, *Corporate Evolution—A Micro-Based Analysis*, MIT Program on Neighborhood and Regional Change, January 1981, and Birch's *The Job Generation Process*, 1979, as the sources of these findings.

> Profit-making institutions cannot bridge the gap between and cannot coordinate the resources or the activities of a variety of privately operated and publicly operated systems of employment-related education and training. There is too much competition among private institutions and systems to permit them to coordinate their activities in the long-range interests of the state. For example, the plan of a state to attract new industry, or to implement its economic development ideas through job training, cannot depend upon the sensitivity of proprietary schools to the current labor market to create the kinds of training programs needed for the future. (Moss 1982, p. 451)

This observation highlights an important difference between public and private sector incentives: proprietary schools are said to be sensitive to current labor markets because that is how they perpetuate themselves; they have no captive clientele. But wait—what is the nature of this alleged difference? Public vocational schools at both the secondary and postsecondary levels must attract students, luring them away from other educational or employment pursuits. So, wherein lies the real difference in marketing appeal? A frequently heard answer is that the public schools offer a more general preparatory program than the targeted proprietary approach. If so, does this mean that enrollee objectives differ between the two sectors? And, pursuing the point through the next logical question: How does any difference in enrollee objectives translate into a conclusion that proprietary school incentives are inconsistent with a state's commitment to attract new and expanding industries, while publicly supported institutions are not so burdened?

In fact, I think, Moss assumes that the proprietary institution requires instant gratification in the form of current labor market relevance, while the state can afford the luxury of building this relevance in reverse order: the proprietary school is assumed to respond to preexisting labor market demands, while the state can presumably *create* a demand within its boundaries. But, at whose expense? If we are talking about a mere statement of commitment to train, rather than actual training conducted in anticipation of attracting employment opportunities, the taxpayers' burden is hypothetical until the offer of subsidy is accepted. If the state invests in the required insitutional and staffing infrastructure and then awaits a response from those who seek the public subsidy, the taxpayers foot the bill, and the payoff on this investment remains hypothetical until the offer of public sector participation in sharing training expenses is accepted. And finally, if the state actually undertakes training to demonstrate the existence of a trained labor force, both the taxpayers and the trainees must await the appearance of employers to receive their respective payoffs. The point is this: the observed sensitivity of proprietary schools to current labor market demands cannot be offered as evidence that these institutions would be unwilling partners in a coordinated joint venture, undertaken in collaboration with public sector partners, to develop human resources in anticipation of their absorption in productive employment. In fact, evidence that is consistent only with the cooperative posture is presented in the third section of this chapter, Exemplary Models.

Finally, consider the following finding:

> While very small manufacturing and retail trade establishments (1-4 employees) generated 26 percent of the new jobs from 1969-76 through births, the other three quarters came from expansion. In the services and agriculture industry sectors the opposite was true. Therefore, as a public policy matter, the emphasis on encouraging new business formation versus the preservation of existing firms has an industry-specific dimension which should be understood in public policy discussions of job creation. (U.S. Department of Commerce 1982, p. 85)

So, not only must we worry about the pulsation phenomenon in devising training subsidy eligibility criteria; the new versus expanding firm sources of employment opportunity must be carefully weighed, too. Encouragement of the formation of new employing units, through training subsidies, may come at the expense of expansion by existing firms, which would have occurred in the absence of the subsidized competition.

Up to this point, no attempt has been made to define our terms with precision. How is *new* to be defined for practical administrative purposes? What does *expansion* mean in routine applications? Both time and geographic boundaries are important here. "New" employment opportunities in one state might well occur at the expense of previously existing employment in another state. This is one of the notable exceptions mentioned earlier with respect to the comparability of federal-state and state-local relationships. Many federal laws prohibit the use of federal funds for encouraging relocation of existing enterprises. The same rationale is applicable to intrastate promotion of relocation using state dollars. What is left, then, is state-level investment in employment that is new to that state, without regard to its genuine newness. Similarly, local expenditures in promoting employment growth would not be expected to consider the external origins of that employment.

The definition of expansion requires consideration of both the time and geographic factors. "Expansion" with respect to what base level of employment, and within which geographic boundaries? If expansion *across* state boundaries is subsidized, expansion *within* states is placed at a competitive disadvantage. Indeed, it can be demonstrated that state subsidies given to new and expanding industries might, in principle, generate no *net* increase in employment, because it is possible that offsetting movements into and out of any given state occur.

Ironically, the larger the level of expenditure on such subsidies by competing states, the greater are the relative advantages given to movers over those who stay. It is not clear how much of this mobility is desirable from the perspectives of the various interest groups that are affected.

Of course, given the intention of one or more states to continue the subsidy practice, no individual state can withdraw from the competition without accepting the untoward consequences that would follow in the form of employment attrition. What we have here, in part, is an example of Veblenian conspicuous production: defensive expenditures are required, which could be withdrawn with no untoward consequences on employment, *if* all other states also agreed to halt their subsidies (See Lee, Stevens, and Wallace (1975) for a related application of this concept).

In summary, the following points have been made about the options that are available to states in their attempts to be sensitive to changing labor market demands:

- The degree to which fine tuning of public sector training investments is appropriate depends upon the actual importance of skill embodiment in hiring decisions and the dynamics exhibited among the varied sources of pertinent skill acquisition (as well as the obvious forecasting accuracy issues, which are dealt with in another chapter).

- Subsidy decisions are both time- and area-specific, requiring careful attention to the pulsation phenomenon and the presence of conspicuous production characteristics.

- At least some reasons, which have been offered in the past, why proprietary schools cannot be counted on to participate in anticipatory human resource development investments are not sustainable. Both careful theoretical examination and existing evidence suggest just the opposite: proprietary institutions have been and can be expected to continue to be willing partners in offering training in anticipation of attracting appropriate employment opportunities to absorb the trainees.

There are many options available to states that seek to subsidize the development of a trained work force. Indeed,

> because the education and training system is so diverse, it provides the opportunity for testing and analyzing various approaches to common policy programs. Whether we are interested in deciding if it is more efficient to finance education through subsidies to individuals, or to training institutions, or if we wish to identify the effective division of training responsibility between schools and workplaces, or if we seek better ways to equalize employment opportunity—the system itself embodies a wide range of useful experiences. (Pannell 1981, p. 65)

This section has accentuated the positive: many options are open, albeit with important practical complexities, some of which have not been dealt with to date. The next section explores the other side of the coin: what barriers impede the effective introduction of public sector intervention strategies, the objectives of which are to demonstrate a willingness to be responsive to changing labor market demands?

BARRIERS TO EFFECTIVE INTERVENTIONS

The barriers to action can be classified in the same way that the options were organized in the first section. There is a logical sequence of events, or decisions, which must be considered. What actual and/or potential employment opportunities are to be targeted for state and/or local attention? In what form(s) is (are) the response(s) to be expressed? Over what time span is public sector support going to be offered? And, where is public sector involvement going to be made available? In other words, barriers to effective intervention can be organized under "what," "how," "when," and "where" headings.

The major barrier to effective state action with respect to the "what" question is often alleged to be deficient information about current and future labor market demands. It has already been noted that the importance of fine tuning depends upon a series of assumptions about what matters in employer hiring decisions. I am well aware of the uses vocational educators make of occupational employment projections. I do not question whether administrative decisions about curricular offerings have been changed, in part, by exposure to this information. What has *not* been demonstrated to my satisfaction is that these altered decisions have, in fact, significantly improved subsequent labor market experiences of enrollees. Too much should not be read into this hesitancy to embrace the information deficiency excuse for inaction or for poor targeting. The pertinent question is: If we knew more, would we do better? The answer depends upon the relative importance of the other barriers to taking appropriate actions.

Assume, for expository purposes, that the decision about what training should be offered has been made (recognizing that, in actual practice, this decision is not independent of the other considerations that are examined below). How this decision is carried out depends upon many factors, among which the following warrant explicit mention here:

- Are public, proprietary, or employer facilities to be used?
- Are public, proprietary, or employer instructional staff to be used?
- Are public, proprietary, or employer instructional equipment and materials to be used?

The actual practices of the states to date differ primarily with respect to how these questions have been answered. (These differences are examined in the third section.) The rigidities that are introduced into public sector decisions about these matters are well known. Can public monies be used to sponsor training conducted on an employer's own premises? Can expert instructional staff members be recruited on a temporary, as needed basis from the private sector, without elaborate credentialing? Can equipment be borrowed or leased on a temporary basis? Can proprietary schools' facilities and staffs be drawn upon when necessary? The best-known examples of state success stories exhibit substantial flexibility in all of these regards.

The major "how" barriers arise in the form of staff, facility, and equipment commitments by public sector institutions. In addition, we have all heard stories about the consequences of emphasizing minimization of material waste (i.e., scrap) during training, only to discover that the time required to economize on spoilage is more costly to employers than is a higher throwaway rate! Again, the states that are generally touted as exemplars for emulation have achieved a better approximation of the employers' production setting than have other states.

Many, but certainly not all, public skill-training institutions are also placed at a disadvantage by the rigidity of their schedules. Many employers seek, and even require, an open-entry/open-exit schedule, which permits offerings closely attuned to production schedules. It is apparently difficult for some institutions to adapt to this degree of openness. Staff assignments and enrollee accrual of credit hours are two important sources of rigidity in this regard.

Many aspects of the "where" issue have already been covered under the other headings. Public facilities, staffs, and equipment are, in varying degrees, immobile. The states that have achieved the greatest amount of private sector participation appear to have done the best job of overcoming these immobilities. As we will see in the third section, one way to do this is to increase capacity, so that opportunities need not be foregone because of insufficient resources when and where needed. This, then, brings us back to the "how" question: How can capacity be kept in reserve, without incurring exhorbitant inventory costs? Again, we will see in the third section how this question has been answered by some of the more innovative states.

Up to this point, we have explored the barriers to state and local actions at a high level of abstraction. Our conclusions can easily be summarized in a concise manner: Deficient information about what to do is often proferred as an excuse for limited success in correcting labor market imbalances, but there are many reasons why "better" information would not be expected to change quickly the size and/or mix or skill training offerings.

We are now ready to explore the record to date. How have states responded to changing labor market demands? And, what actions have been taken to stimulate selected changes in labor market demand?

EXEMPLARY MODELS

Six states have been chosen for detailed examination here: North Carolina, South Carolina, Oklahoma, Mississippi, Louisiana, and Massachusetts. In addition, special mention is made of programs offered in Colorado and Arizona.

North Carolina

North Carolina is generally acknowledged to have made the first formal commitment to development of a statewide postsecondary skill training capability. Twenty-five years ago, in 1957, the North Carolina General Assembly, acting in response to Governor Luther Hodges' initiative, provided for the establishment of industrial education centers. Six years later, these centers, the five then-existing community colleges, and several vocational education extension units were incorporated into a single system. Today, there are fifty-eight technical institutes, technical colleges, and community colleges in North Carolina.

Since 1981, the North Carolina community college system has been governed by the North Carolina State Board of Community Colleges. The Department of Community Colleges is the administrative agency for this system. In 1980, Governor James B. Hunt, Jr., collocated field staff members from the Department of Commerce's Industry Services Division, and from the Industry Services Division of the North Carolina State Board of Community Colleges, in seven regional offices throughout the state, to promote private sector involvement.

Chapter 115D of the General Statutes of North Carolina, which defines the purpose of the community college system, provided the opportunity to create a specialized program of vocational education for new and expanding industries. This is targeted to any new or expanding manufacturing industry that creates a minimum of twelve new production jobs that did not previously exist in North Carolina. (The pulsation phenomenon mentioned earlier is obviously of great importance in applying this definition.)

> In 1979-80, 41 of the state's 58 community and technical colleges provided specialized training for 95 new and expanding industries, trained more than 7,000 employees, and were supported in this effort with over $1.8 million of state funds set aside for this purpose.

> Two-thirds of the training for new and expanding industries is in metals, metal fabrication, electronics, and other types of industries new to the state. (Jackman and Mahoney 1982, p. 37)

It is the responsibility of the Industry Services Division of the Department of Community Colleges to ensure that a suitable training plan is developed for each participating industry and that each program is adequately funded. It is the responsibility of the sponsoring institution to adminster the program in accordance with the plan and all applicable state and local policies and regulations (Task Force on Education and Economic Development 1982). Most training is conducted on employer premises, using employer-provided instructors. State funds may be used for instructor salaries and travel expenses, administrative costs, consumption of nonsalvageable materials, classroom supplies, lease and operation of temporary training facilities, and other related miscellaneous expenses. In other words, the full cost of the training program will be borne by the state. Employers are encouraged to recruit enrollees through the North Carolina Employment Security Commission, but they are not required to do so. Employers are also encouraged to hire trainees, but again there is no requirement that they do so.

In July 1980, a nonprofit Microelectronics Center of North Carolina was incorporated. Drawing upon private, state, and federal sources of support, this organization is intended to coordinate the activities of the community college system, the state colleges and universities, Duke University, and the nonprofit Research Triangle Institute. This ambitious initiative, which is similar in some important respects to the nonprofit Bay State Skills Corporation (Massachusetts), which will be discussed later, is one good example of the possibility of linking public and private organizations in the pursuit of a common objective.

The commitment made by North Carolina public officials to provide substantial amounts of state funds in support of industry-specific training has been consistent throughout the period since 1957. The state's position is clearly one of "you tell us what we can do for you, and we'll get it done." Many important questions remain, however. It is not known whether employer requests for training subsidies exceed the General Assembly's appropriation for this purpose and, if so, what criteria are used in choosing among the requests. It is not known what steps are taken to withhold the offering of subsidies from newcomers who might compete with firms that are already in business in North Carolina. It is not known how the pulsation phenomenon is handled.

On 3 March 1982, Governor Hunt issued an Executive Order to ". . . help us answer the most important question anyone can ask: What skill do I need to learn to get a job that pays well and offers a good future?"* This order established a Governor's Oversight Committee for Official Labor Market Information, at the suggestion of the Governor's Council on Management and Development. An assistant director of the Employment Security Commission has been appointed to coordinate the labor market information system in North Carolina.

South Carolina

In 1961, fours years after its northern neighbor undertook development of a statewide system of technical institutes, Governor Ernest F. Holins of South Carolina urged the General Assembly to undertake a "Study into the Needs of the State Development Board on the Subject of Vocational Training." The legislature thereupon created the predecessor of today's South Carolina State Board for Technical and Comprehensive Education. (Indeed, the administrator of North Carolina's industrial training program was recruited to head the initial effort.)

There are now sixteen technical colleges in South Carolina. These sixteen Special Schools are operated under the management of the Industrial and Economic Development Division of the State Board for Technical and Comprehensive Education. Industrial training consultants are based at each of the sixteen technical colleges. "In addition to our start-up training assistance, the Industrial Training Consultants based at the technical colleges maintain continual contact with industries in their respective service areas. They are ready to trigger additional training programs whenever an industry indicates an expansion need" (South Carolina State Board for Technical and Comprehensive Education, undated, p. 3).

The range of services that the Special Schools program is prepared to offer is similar to that described under the North Carolina heading. This emulative characteristic should not be downplayed in importance, because both the physical proximity and the timing of programs that have been developed to date reflect the significance of competitive pressures exhibited across state boundaries, but within regions. South Carolina emphasizes start-up training, but also supports updating, upgrading, and supervisory development training.

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*Statement by Governor Jim Hunt at a news conference announcing Executive Order 77, 3 March 1982.

Currently, "Design for the Eighties" provides a blueprint for continuing the refinement of the postsecondary system, including development of five technical resource centers (Wilson 1981, p. 47). Unlike North Carolina's extensive offering of within-plant training, South Carolina is said to conduct 90 percent of its start-up training within its own centers. Most instructional staff members are also drawn from the centers, complementing these resources with company personnel when necessary (Wilson 1981, p. 48).

Both North and South Carolina enjoy strong support from their respective general assemblies. In each case, the state vocational education agency is responsible for leadership in all administrative aspects. In both instances, the working relationship with the state's economic development agency is close but informal. In neither state is CETA money drawn upon in any formal manner in support of the training programs described here.

As is the case with North Carolina, our understanding of program regulations and procedures does not permit anything to be said about the basis upon which priorities are established in the event that more requests for subsidy are received than can be funded at current appropriation levels.

Oklahoma

Oklahoma represents another example of emulative replication. In 1967, Governor Dewey Bartlett initiated actions that led to the creation of a separate Oklahoma State Department of Vocational and Technical Education. A Special Schools Division was established within the new state department, with a specifically assigned responsibility to develop custom-tailored job training programs. An Industrial Technical Services Division of the state department is collocated with the Oklahoma Department of Economic Development. It is responsible for supporting the economic development agency's identification of industry training needs.

Modeled, in large part, upon the North Carolina system, Oklahoma's Special Schools program offers customized training upon request. The state's thirty-two area vocational-technical education centers are drawn upon when appropriate, but in-plant and temporary facilities are also used. Both institutional instructional staff members and company personnel are used. A statewide equipment inventory is maintained, but specialized equipment is acquired on a temporary basis, when necessary.

Mississippi

Mississippi initiated a similar special industry start-up training program in 1975. A coordinator position was established within the Vocational and Technical Division of the State Department of Education to maintain liaison with economic development activities in the state. An industrial training supervisor comes into the picture when a specific client company expresses interest in developing a training program with one or more of the seventy-seven vocational-technical centers or twenty-eight junior colleges or postsecondary vocational-technical centers.

Unlike the three state programs previously described, Mississippi provides no categorical funding for industrial training. It is therefore up to the Vocational and Technical Division to work out funding arrangements with the interested organization and with the local institution(s) that would be involved in the training program. Three types of training are offered: preemployment training targeted to immediate job opportunties in new or expanding industries, upgrading training for current employees, and continuing training to meet recurring needs. Both company and institutional staff members, equipment, and facilities are drawn upon (Paul, et al, 1982, pp. 45-52).

The dominant state role that characterizes the North Carolina, South Carolina, and Oklahoma approaches is not exhibited in Mississippi. While the state participates in the identification of interested employers and in the coordination of necessary arrangements between local training institutions and these employers, the availability of funds to support public subsidies is less assured.

Louisiana

All four of the state cases previously described are characterized by control being exercised by the state vocational education agency. Louisiana's Industrial Training Program offers an interesting contrast to this administrative structure.

> The Louisiana Industrial Training Program was first developed in 1974 for the Louisiana Department of Commerce and Industry by Development Resources, Inc., of Charlotte, North Carolina. DRI is a private consulting firm headed by Jay D. Little, Jr. Enabling legislation was passed in 1975 and funding for the program was first appropriated in January 1976 (Wilson 1981. p. 24).

The essential elements of the Louisiana Industrial Training Program are the same as those included in the previously described programs. Both preemployment and on-the-job training are subsidized. Both existing and temporary facilities are used, as are institutional and company staff members. So, the important difference lies only in the state agency that maintains administrative control. It is not known how this difference translates into practical matters, such as certification of instructors, awarding of credit for classroom accomplishments, and duplication of services.

Massachusetts

Even further removed from vocational education's administrative control is Massachusetts' recent creation: The Bay State Skills Corporation, created by the state legislature on 21 July 1981.

> Funds are allocated through the Executive Office of Economic Affairs and the Secretary of Economic Affairs presides as Chairman of the BSSC Board of Directors.
>
> The Board of Directors is comprised of 18 representatives from business, labor, education and a variety of occupational areas. Four of these positions are mandated by law and 14 are governor appointments . . . .
>
> Under the guidance of the board, funds are directed to quality skills training programs where sufficient labor market need and the required private sector participation is committed.*

With the initial appropriation for the Bay State Skills Corporation at $3 million, Massachusetts state law mandates that only public and nonprofit secondary and postsecondary institutions are eligible for funding. In order to receive BSSC funding, private sector contributions, either in kind or cash, must be committed at least to match the amount requested from the BSSC. Program composition, operations, and goals are outlined in a Request for Proposal package.

The enabling legislation for the Bay State Skills Corporation states, in part, that

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*Personal correspondence from Christopher J. Brennan, Assistant Director, Bay State Skills Corporation, 27 July 1982.

> there exists within the commonwealth a critical shortage of training and educational programs necessary to meet the growing needs of business and industry for skilled employees and the corresponding needs of our people for opportunities for new or more rewarding employment . . . .
>
> This shortage is occasioned by the inability of educational institutions to secure the resources necessary for the development and substantial expansion of programs of skills training and education which are consistent with employment need. (The Bay State Skills Corporation Act, Sec. 192, Chap. 40 I)

This statement differs from the four examples previously examined. Here, there is an admission that the institutions themselves cannot expect to attract sufficient private sector support to enable them to maintain the required degree of skill training currency. The commitment of $3 million, coupled with the matching requirement, is expected to provide sufficient incentive to both employers and training institutions to establish cooperative arrangements that would not exist otherwise.

The BSSC enabling legislation gives explicit priority for skill training to those who have become unemployed as a result of a plant closing or other economic dislocation, or to public employees who become unemployed as a result of Proposition 2½. This is the first example reviewed in which explicit eligibility criteria are stated.

Colorado

Still another approach in providing state-level direction to the targeting of skill training expenditures is Governor Richard Lamm's creation of Colorado FIRST: The Colorado Fast-Track Industry Related Start-up Training Program.

The Colorado FIRST program combines funds from the Four Corners Regional Commission, the State Board for Community Colleges and Occupational Education, and the Office of Manpower Planning and Development in the Department of Labor and Employment. This is the first example reviewed in which the employment and training system is involved in an integral way. CETA monies, for example, were eschewed in both of the Carolina programs. The Colorado FIRST program is administered by the Office of Industrial Training in the Division of Commerce and Development, Department of Local Affairs. So, again, we have a case in which the state vocational education agency is not administratively responsible. The subsidies offered are the same as those covered in the previous examples. No participant matching is required.

These state-level coordinated efforts exemplify what can be done. They demonstrate that varied administrative approaches are possible. Other approaches could be cited, but they add relatively little to our understanding of the issue.

In addition to the state-level efforts that have been described, there are many examples of local initiatives by both secondary and postsecondary institutions, which parallel the features already described.*

What patterns emerge in the cases examined here, and what conclusions can be reached about the record to date? The obvious pattern is one of emulation. North Carolina's actions appear to have precipitated reactions by South Carolina, Oklahoma, Mississipi, and Louisiana (as well as other states not mentioned in this discussion.) In all cases, regardless of the administrative agency that is given program responsibility, the basics are the same: Bring the state's willingness to subsidize both pre-and postemployment training to employers' attention and facilitate their use of these subsidies. To date, the catchwords have been "new" and "expanding" employment opportunities. Recently, downside terms have begun to appear in legislative and regulatory statements.†

What direct role do proprietary institutions serve in the state programs described? None. The Bay State Skills Corporation Act explicitly bars expenditure of state funds for other than public or nonprofit uses. In North Carolina, Duke University is involved in the new Microelectronics Center of North Carolina consortium and has long been a partner in the Research Triangle Park development strategy,

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*For discussion of local initiatives, see Wilson 1981; Paul et al. 1982, pp. 45-52; Jackman and Mahoney 1982 pp. 18-36; and Task Force on Education and Economic Development 1982, p. 39.

†Colorado's Division of Commerce and Development has proposed an Economic Dislocation Response Strategy, authors personal correspondence, June 1982. The Utah Job Service proposed an "Emergency Displaced Worker Retraining Proposal" for action by a special session of the legislature in June 1982 (no action was taken on this proposal). Also, see the Bay State Skills Corporation eligibility requirements.

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but in both cases this participation occurs through nonprofit intermediaries.

There are, however, state-level examples of proprietary schools being involved in the provision of short-term skill training services. Since the summer of 1981, New York has offered a "packaging system" to promote start-up training:

> Under the packaging system, every request from business for a specific training program is directed to the State Education Department. Points of contact include the central and regional offices of the State Departments of Commerce, Labor, State, and Education as well as economic development agencies, Chambers of Commerce, regional occupational education planners, education agencies, and CETA Councils . . . .
>
> Once the training needs have been determined, the State Education Department works with one of thirteen Regional Occupational Education Planning Coordinators to decide which institution is in the best position to meet the firm's need, either through an existing or new training program. (Wilson 1981, p. 30)

And, in California, the California Worksite Education and Training Act (CWETA), was passed in September 1979.

> CWETA attempts to address the employment problems of the urban and rural economically disadvantaged, youths, displaced workers and other persons with obsolete or inadequate job skills . . . .
>
> A proposal to institute a training program may come from employers, employee organizations, local education agencies, CETA Prime Sponsors, and other training providers . . . .
>
> To gain approval, a proposal must not compete with or duplicate already existing apprenticeship programs or supplant any vocational training program provided by employers, employee organizations, or any K-14 institutions. Although a private school or community-based organization may conduct classroom instruction, public institutions receive priority. (Wilson 1981, p. 55)

The examples that have been described in these pages demonstrate that a variety of administrative approaches have been adopted to provide state-level direction to subsidized entry-level training, upgrading of existing skills, and supervisory training. In most instances, the state vocational education agency has taken the lead in this respect. Also, in most cases, working relationships with other agencies are informal. Collocation of field staff persons from the vocational education and economic development agencies is used in North Carolina and Oklahoma. Collaboration between the vocational education agencies and their employment and training counterparts has, in most cases, been limited.* The length of training offered varies widely, both within any given state and across the state programs examined. Few have a mandatory ceiling on the permissible length of a training program.

The responsiveness exhibited in the programs reviewed here has uniformly appeared as a state's willingness to bear all or most of the costs of training for "new and expanding" firms. Indiana's Training for Profit Program typifies the sweeping criteria that are used in screening the proposals of applicant firms:

> The Department of Commerce identifies new and expanding business and industry which meet criteria as potential for long-term growth, adding diversity to the kinds of industry or manufacturing within the state, enhancing existing business, industry and service providers, and serving the market needs of Hoosiers and Hoosier companies. (*Key Questions*, undated)†

A fundamentally different type of response is illustrated by Arizona's analysis of the purchasing patterns of the state's high technology firms, focusing on the potential for growth in industries that supply the products, services, and commodities required by these large manufacturers. . . . "Manpower, vocational, and professional education planners will be assisted with the information on the occupational implications of future high technology related economic development" (Arizona Office of Economic Planning and Development 1981, p. 5).‡

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*See *A Vocational Educator's Guide to the CETA System* by Atteberry and Stevens for an explanation of why this pattern should be expected.

†Also see Indiana Senate Enrolled Act 250, 1 July 1981.

‡Also see Wassily W. Leontief 1982 for an example of the application of input-output analysis in a simulation context that demonstrates the effects of different automation assumptions on employment patterns.

It is simply not possible, on the basis of the evidence reviewed, to determine the *net* impact the state training subsidies have had on intrastate employment. Glowing assertions abound that each of the states referenced here, and others as well, have experienced tremendous increases in employment, earnings flow, and tax revenues *because of* the commitment of state resources to develop a partnership with private industry in creating and sustaining a trained labor force that is flexible in the face of changing demands. "What would have been" is, of course, open to conjecture: hypothetical circumstances, which are unobservable, can be molded in many ways, depending upon the storyteller's assumptions. What if North Carolina hadn't taken the initiative in the late 1950s? What if the regional commission monies hadn't become available in the 1960s and 1970s to facilitate the spread of area vocational-technical schools in many states? Would fewer interstate moves of employing establishments have been observed? Would the frequency and amplitude of employment pulsations have been reduced? Would private industry have borne a larger share of the training costs involved in producing its goods and services? Would the demographic characteristics of those who received skill training have been different? None of these questions can be answered here, and, to my knowledge, none have been answered elsewhere.

RELEVANCE FOR THE FUTURE

So, what about the future? Given the actions that have been taken to date, what can we expect to observe in the coming years? The Job Training Partnership Act of 1982, which replaces the Comprehensive Employment and Training Act, places greater emphasis than ever before on skill training as the vehicle to remediate the circumstances of designated target groups. The role of the National Occupational Information Coordinating Committee and its state affiliates is examined in the chapter by Lane Rawlins. Given information availability, what distinguishes those who act from those who watch? In one word: accountability. Interstate competition in a generally weak economy has quickened the pace of industrial recruitment investments. Fiscal stringency has increased intrastate scrutiny of institutional relevance.

In many if not most states, fiscal ability to respond has been drastically weakened at precisely the time when competitive forces require a defensive commitment of state monies to sustain employment opportunities. In such circumstances, will the rich get richer, and will they do so at the expense of the poorer states? Mobile enterprises are in a very strong bargaining position at the present time. Many states already have the institutional capability to respond to expressions of interest in collaborative training, and other states are exploring ways to achieve a similar status. It is unlikely that the relative balance of power will shift toward the states and away from employers in the foreseeable future.

Indeed, I would expect to see even more creativity exhibited in cooperative arrangements involving public vocational schools, community colleges, proprietary institutions, and employers—arrangements in which the public/private distinction is blurred even more than it has been to date. At the same time, "holdouts" will remain, because incumbent insecurity among the administrative and instructional staffs at some public institutions will effectively bar acceptance of the types of partnerships exemplified in the third section.

The challenge to state and federal vocational education administrators, then, is to identify these pockets of resistance and to develop strategies to overcome the reticence. This assumes that the competitive forces should be responded to and that the joining of public and private resources, which has been building in some states for several decades now, should be emulated. This, of course, is a decision that will be made by each state's citizens.

RECOMMENDATIONS

On the basis of the previous discussion, the following recommendations are offered.

1. This chapter and the primary and secondary sources used in preparing it fall short of the degree of specificity about state actions taken to date that would be of interest to a state legislator or administrator who is contemplating emulative action. It is therefore recommended that an inventory of state legislation, executive actions, amendments to each of these, and ancillary administrative regulations be compiled and updated annually.

2. Specific barriers to action are alleged time and time again. These include an inability to accommodate open-entry/open-exit practices, difficulty in hiring instructors becaue of credentialing requirements, obstacles to entering into short-term leasing agreements for facilities and equipment, and foot-dragging in achieving public

sector and proprietary cooperation. It is therefore recommended that explicit attention be paid to ways in which each of these impediments has been surmounted to date.

3. Anecdotal evidence suggests that the proprietary sector offers an opportunity to take advantage of increases and decreases in the scale of training enrollments without incurring untoward effects on a rather rigid public sector resource base. Given these facts, it is recommended that a detailed examination of cooperative undertakings be made. The case study materials referred to by Jack Meyer, of the American Enterprise Institute, offer an example of what might be accomplished.

4. The "pulsation phenomenon" referred to in the first section of this chapter warrants further examination, with specific attention being paid to its appearance among firms that have been subsidized in the past. The most important issue is what has happened to those trainees whose skill development was subsidized.

5. The mover/stayer issue (companies that move/companies that stay in one place) also warrants additional attention, insofar as the possible consequences of unnecessary mobility of production locations are masked by the attention given to date to "new and expanding" activities.

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V. LANE RAWLINS

13

An Overview of Local Coordination and Linking Efforts Among Employment and Training Programs

PURPOSE

The variety of state and local programs related to human resource development can be seen as an overall system, or process, for meeting changing labor requirements. It is a complicated system, having literally hundreds of component parts or programs that have been described and evaluated in numerous government and academic reports. Rather than focus on individual program descriptions, the major objective here is to examine the interactive dynamics of the system by focusing on internal coordination and linkage.

The chief sources for the information presented here are the hundreds of interviews conducted by the author for various field studies on human resource development programs, as well as the distilled observations of dozens of other field researchers who have participated in the same or related studies. Another source is state and local documents on cooperation, coordination, and consolidation within the human resource development system, particularly in the state of Washington.

An attempt is made throughout to deal with the system as it actually functions and to avoid the temptation to build an abstract model for maximizing effective service delivery. There is little point in

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playing the role of a social architect on the tacit assumption that the present system can be cleared away and an ideal structure built. The existing agencies and programs have a variety of sources and purposes. Vocational education is authorized by state legislation often dating back a half century. The U.S. Employment Service in the U.S. Department of Labor had its roots in the Wagner-Peyser Act of 1935. Federally sponsored labor training programs date back to the early 1960s, and state and local jurisdiction over federal programs was created by the Comprehensive Employment and Training Act (CETA) prime-sponsor concept in 1973. Coordinated systems for gathering job market data by state and locality have existed for a long time but were given a methodological and financial boost in the late 1970s. These and many other programs and concepts constitute a loose human resource development system. Its effectiveness depends on how the individual parts interact. Even with this loose system, some prescriptive concepts for using its components are useful, and these will be given in the final section.

THE CONCEPTUAL FRAMEWORK

The methodology for this analysis is "institutional" in nature. That is, the roles of collective action or institutions—in the form of the laws, rules, and customs that govern day-to-day behavior—are explicitly considered in attempting to understand why the system works as it does and how it will respond to new challenges. As suggested by John R. Commons (1950), a leading institutional economist from another era:

> Public programs and policies cannot be evaluated in terms of the logical consequences of isolated assumptions . . . they must be judged by the practical consequences of their operations. This requires a subtle balancing of many parts . . . it means continuous attention to the resolution of conflicts . . . it means the full consequences can never be anticipated before the programs are put into effect . . . it requires that analysis must come to focus upon judgments which evaluate the parts in relation to the whole and take account of the strategy and timeliness of action. (pp. 137-138)

The history of the system is critical to understanding present relationships and their response to change. Investigation of the problem-solving apparatus within the system makes it clear that it is an intensely political process. While all components of the system have a more effective and efficient labor *market* as an ultimate goal, they respond directly to political forces and only indirectly to market signals. There is no invisible hand to regulate their activities, no price system to allocate the resources correctly, no profits or losses to separate the successes from the failures. Behavior in this political arena, especially as it applies to individual agencies or program operators in the short run, is governed by the existing rules of interaction and by power relationships.

The current human resource development system emanated from a series of political decisions intended to balance a variety of interests, usually in response to such special problems as excessive unemployment, skill shortages, discrimination, or labor immobility. How the system responds to new challenges and new problems will depend partly upon establishing a programmatic design that does not seriously upset the balances of existing power relationships. Therefore, in order to determine whether this system really has response capability, it is important to focus on conflicts of interest that may arise and on the rules and rulemaking *processes* for accommodating those differences.

Many of the conflicts involve territoriality. Each agency or program operates within a limited field, where it is protected by laws and traditions that define its "jurisdiction." Individual jurisdictions tend to become institutionalized and to develop a strong bureaucratic and constituency-based resistance to any changes that threaten their control of their "turf." The most resistant (and consequently most interesting) problems in coordinating this system involve rationing of political power and jurisdictional authority.

Numerous studies have identified programs that would benefit from greater interaction and coordination with other parts of the system. Often there is a tacit assumption that this identification will result in increased voluntary cooperation. Too often, this cooperation has not occurred. When coordination is seen as a power-rationing process, it is clear that to be effective, it must go beyond voluntary association to bargaining and even command decisions.

Finally, it is important to recognize that coordination and linkage are not always beneficial. There are significant benefits in decentralization and autonomy, especially where a single agent is responsible for the outcome.

DESCRIPTION OF A HUMAN RESOURCE DEVELOPMENT SYSTEM

This section presents a brief descriptive overview of the human resource development system in the state of Washington. While some components of the system are unique to that state, studies have shown that it is fairly typical. This allows it to be used as a framework from which general questions of coordination and linkage in pursuit of labor supply objectives can be addressed.

The human resource development system, as defined here, includes all of the major public and private components that have as their ultimate objective the training of people for labor market vacancies. These components are classified as three major categories: (1) information and planning, (2) training, and (3) job location and placement.

As shown in figure 13-1, there is an assumed logical sequence of functional interaction among these activities. The desired sequence is simple and well known to human resource development planners and researchers. First, information and planning agencies or programs are responsible for identifying both the needs of the population and of the labor market. This requires the accumulation of accurate and timely data as well as a method for projecting future needs. This information is then used by training agencies in the design and operation of their programs.* The final stage is location of jobs and suitable placement for trainees. Clearly, the success of this system requires close coordination throughout, although coordination alone will not assure success.

Information and Planning

The most difficult task for this system is the provision of reliable forecasts of labor market demand. Major contributors to this effort in Washington state include: (1) the Occupational and Employment Statistics System, (2) the Job Opportunities Forecast, (3) Private Industry Councils, (4) Department of Social and Health Services reports, (5) State Occupational Information Coordinating Committees, and (6) other sources of reports.

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*Included under the *training* rubric are all those activities necessary to prepare the trainees for the labor market. Therefore, counseling, remedial education, and "life skills" training are included with actual job skill training.

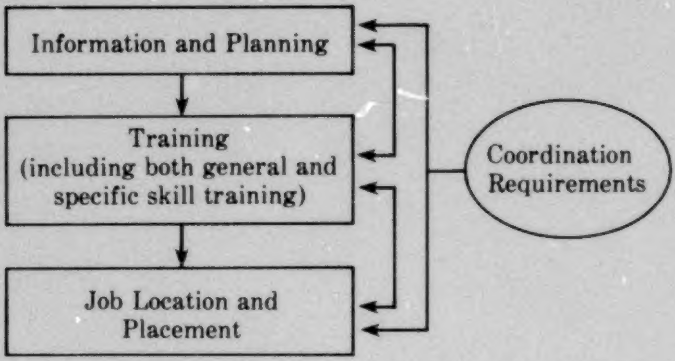
Information and Planning
Training (including both general and specific skill training)
Job Location and Placement
Coordination Requirements

Figure 13-1. Desired sequence of functional interactions among human resource development activities

Occupational and Employment Statistics System (OES)

The OES unit is a part of the U.S. Employment Service located in the Department of Labor. While the system is not yet fully operational, it is able to provide labor market demand projections for selected industries up to 1987. The forecasts are based on comprehensive surveys of employers by industry, from which industry profiles are produced for each three-digit SIC (Standard Industrial Classification) code. The profiles are more than simple projections, since they reflect an analysis of survey data that take regional trends and economic forecasts into account. Nevertheless, there is clearly room for considerable error, since the projections really consist of forecasts based on forecasts. Although the OES system has widespread political support, the data are not widely used at this time. Research shows that many training agencies are not even presently aware of this data source.

Job Opportunities Forecast (JOF)

The JOF has a more limited objective than OES. Authorized through the Commission for Vocational Education (CVE), its sole purpose is to provide planning information for vocational education by forecasting occupations where training can be or is now provided through the traditional vocational education system. Like OES, it is based on some survey data.

Private Industry Councils (PICs)

Although the legislated functions of PICs may include all human resource development system functions, in Washington their functions are mainly information gathering, analysis, and planning. Made up of local representatives of private industry, the PICs were established to bring private industry and publicly funded human resource development programs closer together. In particular, this requires a good working relationship with the local CETA prime sponsors.

The primary functions of most PICs in Washington, as they now operate, include the following:

- Review prime sponsor plans and programs.
- Make recommendations on goals and policies.
- Provide information on private sector job opportunities.

In Washington, as well as in the sample areas for the Princeton Public Service Employment (PSE) study, the PICs are finding it difficult to identify and fill a comfortable role. They have not revolutionized the human resource development system, as the 1978 Amendments to CETA suggested they should. However, many PICs do serve a useful function by relaying local private employer impressions and forecasts of future labor demand to training agencies. The result is a small but discernible shift in training programs toward practical job skills. Restrictions on trainee characteristics (greater focus on the more disadvantaged) have limited that shift by discouraging private industry's interest in the graduates of training courses.

Department of Social and Health Services (DSHS) Reports

Although DSHS does little occupational forecasting, it provides data on population growth and demographic characteristics that are useful in planning.

State Occupational Information Coordinating Committee (SOICC)

The SOICC has representatives from most of the state's major human resource development agencies. Its mission is to improve coordination among these agencies by providing access to data that serve their common needs and facilitating the widespread use of labor market data in planning.

Other Reports

At one time or another, virtually every agency and locality either conducts a survey to determine labor market needs or contracts with a consultant to do so. These surveys reflect the interests of varying target groups and special interests. Often the end product is a compilation and analysis of data provided by the other systems.

Training

Local CETA prime sponsors have been major initiators for federally financed job skill training for the past nine or ten years. Their authority over the federal CETA grants has made them key actors in the human resource development system, although CETA staff provides no actual skill training. When skill training is needed, CETA prime sponsors contract with skill-training agencies or, in the case of on-the-job training or public service employment, with employers.

In addition to the CETA prime sponsors, the skill-training apparatus includes (1) private nonprofit and profit institutions ranging from Opportunities Industrialization Centers (OIC) to beauty and business colleges, (2) community colleges, (3) vocational technical institutes, (4) correctional instutitions, (5) DSHS, (6) PICs, (7) institutions of higher education, and (8) the public school system.

Comprehending the administrative structure for governing these training institutions is important in understanding the system. The local prime sponsors are appendages to autonomous local governments and are really more independent of state action than are the vocational education organizations. Vocational education activities are coordinated by the Commission for Vocational Education (CVE), whose members are appointed by the state governor. The major components of the vocational education system are the community colleges, the vocational-technical institutes, and vocational education components in secondary education.

The community colleges are governed jointly by local boards and the State Board for Community College Education (SBCCE). Local boards are locally elected, whereas the SBCCE is appointed by the governor. The superintendent of public instruction is an elected official who administers the vocational-technical institutes along with primary and secondary education. Of course, there are also local and state boards involved in this process.

The more deeply these jurisdictional relationships are probed, the more it becomes clear that local political actions are important for coordination and linkage in the system. An example of the political nature of these governing bodies can be seen in the SBCCE, which is a seven-member committee with one person from each of Washington state's congressional districts. The districts' activities in vocational training are to be coordinated by the CVE, which is also a seven-member committee made up of five citizen appointees, the superintendent of public instruction, and the director of SBCCE. While this organizational structure is unique to Washington state, it is typical of other states in terms of the complexity of the organization and the types of training institutions.

Job Location and Placement

Most training agencies have a structure for job placement, which may range from a single placement officer who sets up interviews and contacts potential employers, to an extended job development program that includes special training in job-finding techniques.

The former structure is most typical of training institutions where the emphasis is on training all enrollees in traditional skills. The latter structure is more often found in programs that restrict trainee eligibility to the "disadvantaged" or to special "target groups." At the institutional level, a vocational-technical institute is likely to have one placement officer with industry contacts, whereas a special program for CETA clients may devote extensive resources to job development activities such as job clubs, courses in resume writing, lectures in how to dress for a job interview, and so forth.

The state's employment service agencies play a major role in job placement activities. They are the only agencies in the state system with job placement as their sole function. However, most of their services are not closely linked to the information and training components of the system. Despite extensive long-term efforts to increase the role of the Washington Employment Security Department in the human resource development system, it remains primarily a clearinghouse for unskilled and semiskilled jobs. In some areas, it has been remarkably successful and efficient, but a number of serious institutional barriers appear to preclude a major expansion of the role.

Summary

The state's array of human resource development programs does not constitute a single coordinated system. While there are some linkages among the programs and agencies, Washington's system seems to have several processes that parallel each other. Viewing the core of each process as a training activity, it is evident that most training agencies rely partly on their own planning information, and also conduct the majority of the limited job placement and job development activities to which their trainees have immediate access. Duplication of effort is found throughout the system, although each of the seemingly parallel processes has a somewhat different emphasis, client group, or proposed solution to a problem.

MAJOR FACTORS LIMITING COORDINATION AND LINKAGE

Labor Market Information

In early 1982, the governor of the state of Washington, acting on the advice of the newly appointed Washington State Employment and Training Council, authorized a series of regional meetings at which interested parties and private citizens could comment on the human resource needs of the state. In each of these meetings, the lack of reliable labor market information was stressed by conference participants as a serious limitation to effective program planning. The attention given to this issue was not new nor was it a surprise. In reports prepared for Washington state in 1976 and 1977, the lack of reliable labor market information was also identified as a barrier to coordinated human resource planning (Knowles and Rawlins 1976). In the interim, several major efforts to develop and disseminate labor market information and projections of labor demand had been initiated.

The need for better labor market information is stressed by human resource development programs and agencies everywhere. In the Princeton study of CETA-PSE (Nathan et al. 1981), which included forty local areas across the country, poor labor market information was repeatedly cited as one reason that CETA prime sponsors were not able to train public service employment workers for shortage occupations. Yet, in most states there is information available through OES or similar projects, providing detailed forecasts of labor demand by occupation and industry. These data could form a labor market data base around which training activities could be coordinated. However, it seldom works that way.

The regional meetings just mentioned identified three major problems with the available information. First, data were not tailored to the special needs of individual training agencies. This complaint was most often voiced by agencies attempting to train the labor market disadvantaged for job placement. The agencies felt that the data did not identify the actual skills required for the lower-skilled jobs and that there was little or no data on skill substitution.

Second, there was widespread feeling that demand projections did not take adequate account of new technological developments in computing, robotics, and other high-technology industries. There was a growing concern expressed that these technological changes are likely to require skill training that training institutions do not know how to provide. Private employers made many comments criticizing the system for not responding to current needs. This position was also taken frequently by representatives from vocational training agencies who were asking for better program direction.

Finally, representatives of virtually all segments of the community commented that the projections were based on excessively optimistic assumptions about the economy. This was usually followed by a suggestion that local economic recovery depends on attracting and developing new industry and that labor demand forecasts cannot project the needs of such new industry.

In view of these criticisms and current plans for data provision, it appears that most components of the system in Washington state will continue to assemble their own labor market information and that these differing sources will continue to constitute a barrier to a completely coordinated system. This barrier to coordination is probably not the result of a diversity of goals and objectives, however. Rather, it most likely stems from a distrust in any single source of information.

Complexity of the System

There is an implicit assumption underlying all coordination activities and projects, which is that duplication results in waste that would be eliminated in a more coordinated system. Among other things, that view ignores the costs of coordination activities themselves. At the operational level, the human resource development system of any state or major city involves dozens, if not hundreds, of units. The costs of coordination activities among these units would depend upon the extent of linkage desired.

Some indication of the range of scope of possible coordination efforts is shown in figure 13-2, a coordination matrix adapted from a paper by Carl VanHorn (1981). Even prior to the first stage of coordination, however, a general knowledge of other activities in the system is required, which would involve meetings, review time, and planning sessions.

State of Coordination	Required Activity
Information sharing	Exchange of plans and notification of other agencies of activities.
Consultation	Contact prior to implementation of activities and invitation to comment on plans.
Shared control	Jointly authored plans and program activities directly linked or done commonly.

Figure 13-2. Coordination matrix for human resource development systems

Knowles and Rawlins (1976) identified eighty-five major statewide programs in Washington that were directly related to employment and training activities. Many of these programs had several components. The inability of each program to keep up with what the others were doing was a major impediment to linkage, but the sheer effort and time involved in a genuine sharing of information constituted an insurmountable obstacle. What was—and is—needed is some way of selecting the critical areas where coordination is likely to have a payoff that is worth this investment. In fact, many of these selections are made in the local problem-solving setting.

Political Independence

In the ranking of impediments to a more coordinated system of human resource development services, "turf" considerations get a fairly high place. The desire to protect individual jurisdictions from absorption or dilution resulting from interaction with other agencies and programs is particularly important because it is one of the least justifiable reasons for independence. At the same time, it is one of the most difficult to overcome. Removal of political barriers is doubly difficult because they are intertwined with the more defensible reasons for maintaining independence, such as complexity of the system and differences in objectives.

Conflicting Objectives

Each of the agencies or programs in the system is in some way attempting to improve the labor market matching process. Underlying this potentially cohesive mission, however, is an amazing complexity of multiple and often conflicting objectives. The most persistent and difficult conflicts come from attempts to solve both supply and demand problems with the same set of programs. The following example is typical of a process that has been repeated in virtually every local area over the past twenty years.

There is an excess demand for workers in some skilled occupation, which is reflected by both rising relative wages and job vacancies. At the same time, there is a high unemployment rate in some population group identifiable by age, sex, race, and/or income. Putting those facts together, someone gets the idea that they should train the target group for the job vacancies.

At that point they have a training program plan that requires some form of public or private subsidy, since the unemployed target population is not likely to have the means to pay for the training. To fit the criteria for public subsidies, the program is required to operate at a limited level and to be of short duration. In the meantime, the market signals picked up by the program planners are also seen by numerous other training institutions and by bright young trainees looking for career entry points. Many of these trainees can pay for extended training; or, if the training can be built into the curriculum of a state-supported college, the size and time limit for the subsidy can be extended to several times what is allowable for the more disadvantaged trainees. The subsidized program is likely to fail because the objectives—training the disadvantaged and filling vacancies for skilled workers—are incompatible in the real world labor market setting.

There seems to be considerable resistance to recognizing this problem. For example, the CETA-PSE program, which was finally discontinued in 1981, required extensive coordination among CETA prime sponsors, the state employment service agencies, training organizations, and public or private nonprofit employers. Field studies conducted in 1977 and 1978 (Nathan et al. 1979) showed that this was a relatively effective program for moving the unemployed into permanent public sector positions across the entire occupational spectrum. However, the program was criticized because, even though the program participants had suffered long stretches of unemployment, they were often not the most disadvantaged in their communities.

In 1978 the problem was "corrected" by a set of wage limitations and participant eligibility requirements that pushed the program toward training the most needy. This action reduced the willing involvement of many potential employers and converted PSE to more of a "make work" program for people who, in many cases, needed extensive skill training and support services to prepare them for full-time productive positions. Although there was strong local opposition to the imposition of the 1978 changes, there was very little resistance when the program was eliminated in 1980-81. Because the program had become unacceptable to a necessary component of the coordinated process—the employers—the linkages necessary for a successful on-the-job training effort were no longer possible.

As another example, a dispute arose between a social services agency and the Washington Employment Security Department over who should conduct job placement activities for welfare recipients.

Many issues were raised in the confrontation, but the dispute finally centered on a difference of objectives. The social services agency viewed serving the clients as the primary object of its service while the Employment Security Department was most interested in serving the needs of employers. In this case, placement was the outcome sought by each agency, but the perceived difference in agency orientation prevented a coordinated effort.

Agencies with different missions cannot be expected to coordinate all of their activities. It is important, especially where linkage is required for effective service delivery, to make the goals and objectives of all programs in the system compatible and realistic. But that possibility is limited.

The major goals of the human resource development system include—

- improving basic literacy,
- serving the disadvantaged,
- eliminating discrimination,
- serving the needs of industry,
- attracting new industry.

While there is no inherent conflict among these goals, emphasis on any one of them may lead to a concentration of scarce resources that does not best serve the others, and may therefore engender interprogram tension.

Private Firms and Public Purpose

The dual emphasis on job placement and meeting the needs of industry is a continuing problem for planners in education and training. Recongizing that most jobs and job training are in the private sector, the proposition that the public human resource development establishment should be better linked with the private sector has never been seriously questioned. The issue becomes how to do it.

The obvious need for a greater public-private partnership in labor training has fostered a number of programs, each of which began with much fanfare but failed to reach its objectives. The reasons for this can be illustrated by a discussion of three major philosophies under which the public-private program efforts can be arranged.

First, the public sector defines human resource development goals (with some private sector input) and creates a system of incentives to induce private firms to pursue them. The incentives are primarily financial but may also include the promise of good public relations (as in the Job Opportunities in the Business Sector [JOBS] program). A majority of these programs involve wage subsidies or tax incentives for private business. Examples include the on-the-job (OJT) components of the Manpower Development and Training Act (MDTA) and the Comprehensive Employment and Training Act (CETA), Targeted Jobs Tax Credits (TJTC), and the Work Incentive Tax Credit for welfare recipients. The common element in these programs is that, in return for some subsidy, private firms agree to expand employment by hiring and training target group members whom they would not hire in the absence of that incentive.

Second, the "servant of industry" approach encourages the publicly funded human resource development system to take directions from private industry. While not really a national program, this approach is promoted by having employer representation on human resource planning councils. Many prime sponsors agree to pay for special training programs if employers agree to hire the graduates. The "catch" is that the trainees are selected by the public agencies, although the employer is not bound to hire those who are not satisfactory.

The third approach is to turn over the programs to the private sector to do the planning, arrange for funding, and conduct the training. This is the central idea behind the Private Industry Councils. In most areas, the PICs have not been willing to take on this full responsibility, and the actual practices fit better into the "servant of industry" approach. As in the other cases, the trainee target group is restricted.

Most current attention is on the first approach—creating incentives. The individual program designs vary, but the principles remain the same. These are given some impetus from studies showing that the cost-benefit ratio for MDTA and CETA programs shows higher gains from OJT components—which fit into the incentive approach—than from the other training activities. However, as Levitan and Mangum (1981) suggest, the measured costs of OJT programs do not include "the difficulty of marketing OJT, the high administrative cost of the personalized contracting process, and the overrepresentation of marginal employers among the contractors" (p. 28).

A major difficulty in measuring the returns to OJT and other incentive programs is in determining whether there was an actual expansion of employment. If the trainees were hired in lieu of others who are now unemployed, there is little benefit. In any case, subsidized OJT has remained small and has been difficult to sell to employers.

Recently, more emphasis has been placed on programs providing tax incentives for employment. The Revenue Act of 1971 authorized the Work Incentive Tax Credit, allowing firms to claim 20 percent of the first year's wages of former welfare recipients as a tax credit. In 1975 this credit was extended to Aid for Dependent Children (AFDC) recipients, and in 1979 the allowable benefits were raised to 50 percent in the first year and 25 percent in the second. This program was never widely used, and at its maximum (1977) it generated only $38.2 million in tax credits (Carcagno and Corson 1982). The program also created the possibility for extensive abuse, and many observers felt that much of the credited employment would have existed without the tax credit.

The Targeted Jobs Tax Credits program is similar to the Work Incentive Tax Credit program in form as well as in results. This program is also not generating widespread participation, since there is evidence of considerable abuse, and there is suspicion that most of the jobs would have existed anyway. The one program of this type that seemed to have met its objectives was the New Jobs Tax Credit program of 1977 and 1978, which apparently had a significant positive impact on employment growth. However, the program lacked one feature that dissuaded private cooperation in the other incentive programs—targeting the jobs to specific population segments.

An important point to be made about private sector incentive programs to stimulate employment is that the participation rate must be very high before society can begin to realize substantial benefits. As John H. Bishop (1982) suggests:

> If only some of the workers needing employment assistance are subsidized, the scheme helps the subsidized workers obtain jobs at the expense of the job prospects of equally needy unsubsidized workers. Thus, when participation rates are low, displacement rates are high, and the net increase in demand for target group

> workers is very small. . . .By a participation rate criterion, all the targeted employment schemes tried in the United States—Job Opportunities in the Business Section, CETA-OJT, WIN, and TJTC—have failed. (p. 285)

In view of the substantial incentives that have been provided for private industry, some of the blame for these programs not having had a major employment impact must be regarded as a failure of program administration, or coordination, to provide a means by which both the public and private participants could realize their goals at reasonable cost. The feedback on these programs suggests that the administrative costs are high because agreement on a workable process has never really been reached.

Administration of a program requiring public-private cooperation presents many difficult problems. In a recent paper on administrative issues for targeted employment subsidies, Carcagno and Corson (1982) outline some of the administrative choices that accompany the program implementation. For example, which agency should have primary responsibility for administration? Who should be responsible for measuring new employment? Who should certify that employees and employers are eligible? How will the subsidy be calculated and disbursed? How will the program rules be enforced? How will employees and employers be encouraged to participate?

Many of the most challenging administrative problems are not addressed by Carcagno and Corson, however. Answering the questions listed here still fails to give guidance to implementation and effective management of an actual working program. At a minimum, an effective targeted employment subsidy program that can attain high participation rates will require a coordinated effort of the Internal Revenue Service, Regional Department of Labor Offices, the Washington Employment Security Department, CETA prime sponsors, and the private sector. In the case of fraud or abuse, other agencies must also be involved.

The big administrative issues are not in deciding what to do, but in determining how to do it. Problems in linking private and public parties involved in human resource development appear to fall into two categories. First, there are differences in the goals and objectives. Second, program administration costs deriving from a complexity of rules, as well as the public's inability to coordinate the system up to the point of private sector contact, tend to discourage private participation.

Unless the goals are consistent and compatible, the programs should not be attempted. If the differences in goals are understood and can be accommodated, then the public sector must resolve the problem of designing a workable system. At present, both problems stand squarely in the path of a public-private partnership that has the ability to respond to the new demands of the labor market.

ATTAINING AN INTEGRATED HUMAN RESOURCE DEVELOPMENT SYSTEM

The human resource development system consists of three major institutional components: vocational education, public "problem-solving" human resource development agencies (such as the CETA system and the Employment Security Department), and employers. There has been no lack of federal, state, and local initiatives to secure better working relationships among these components. Clark (1982) has reviewed these efforts, particularly between schools and industry, and has compiled an impressive list of federal programs, demonstration projects, and local activities. However, his conclusions are that the level of coordination attained has been minimal and that "current industry-education joint efforts continue to be conducted, for the most part on a fragmented, duplicative, uncoordinated and ad hoc basis, against the backdrop of rhetoric calling for improved linkage . . ." (pp. 415-416).

Satisfactory explanations for this persistent lack of integration among the parts of the system are seldom found in papers addressing the topic, and many policy recommendations call for more of the same types of programs. This is especially troubling if we take at face value the underlying assumption that integration is needed and should be promoted.

In the previous section some of the most obvious impediments to cooperation were discussed. Many of these involve real costs, including the time and resources that must be used in sharing information and in arriving at a jointly acceptable plan. Others are more related to institutional forces that perpetuate existing practices, even though the situation that may once have justified those patterns no longer exists. Another is that the objectives are not well defined or completely shared among the relevant parties. Although a completely integrated system is neither feasible nor desirable, there is a need to implement better processes for shared information, consultation, and control where the barriers to coordination are surmountable.

The feeling of urgency for a planned, integrated system is perhaps greater now than in the past because of the persistence of high unemployment, the widespread feeling that our schools are failing to teach useful skills, the apparent confusion about the skill demands of the future, and the widely publicized view that government activities are nonproductive.

Leadership: The Role of the CETA System

It is quite possible that the leadership for this effort will arise out of the remains of the CETA system. The extensive analysis of the successes and failures of its individual programs has neglected to assess the impact of a decade of CETA programs on the fabric of state and local human resource development institutions. Both the size and unique administrative structure of CETA programs over the past decade have been important in this respect.

As part of Nixon's "New Federalism," CETA was founded on the principles of decategorization and decentralization of human resource development programs. Of course, those principles were never fully realized, since the federal government continued to limit CETA grant use by delineating eligible target groups, allowable subsidies, and types of training. These federal restrictions on local control should not obscure the fact that CETA created a vast network of nearly autonomous local units that implemented human resource development policy in a variety of forms. Those units became large departments within existing state, city, and county governments. Even when consortia of several governments united to obtain CETA grants, the usual arrangement was for the funds to be divided among the governments according to some prearranged plan. In its biggest years, when CETA-PSE was a major countercyclical program for the Carter administration, CETA was the largest single item in many local and county budgets and was given commensurate political attention.

Because CETA was a decentralized system, where the administering political units bore only accidental correspondence to labor market areas, the federal government recognized from the outset the need for coordination and linkage within CETA. Several coordinating mechanisms were built into the legislation, including (1) bonuses to jurisdictions that would combine operations; (2) a requirement that each prime sponsor have a planning council with representatives from vocational training, social services, and the private sector; (3) provisions for statewide human resource development planning councils to coordinate the activities of the local prime sponsors; and (4) a general mandate for coordination of CETA activities with all relevant programs. While the degree of program linkage varied across jurisdictions, the rules of the CETA system facilitated the sharing of information necessary—though not sufficient—for cooperation.

At the operational level, the noncategorical CETA system provided funds for an amazing variety of training, research, demonstration, job placement, information gathering, public relations, and coordination activities. These programs overlapped the jurisdictions of virtually all state and local operations in training and human resource development.

The CETA programs are now much reduced from the 1977-78 peak. The new federal mandate is for better coordination with the private sector, and the system has some of the tools to facilitate that interaction. In particular, it has developed a cadre of human resources experts who have a much clearer view of the objectives and programs within the various components of the human resource development system than do practitioners who have spent their careers in the more traditional agencies. Since the CETA system was always a catalyst rather than a service deliverer, it is not surprising that much of the initiative in new coordination efforts comes from that program.

Implementation

The methods for attaining a better coordinated system fall into four categories: (1) increased voluntary cooperation, (2) legislative mandate, (3) funding or management control, and (4) bargaining.

Voluntary Cooperation

There is extensive voluntary cooperation in sharing of information within the system. For example, welfare agencies typically share individual client information with training programs for the disadvantaged. Where training sequences are possible, there is also considerable linkage, as is seen in the relationship between CETA prevocational training programs and vocational training institutions. Voluntary cooperation generally comes to an abrupt halt, however, when there is a jurisdictional threat or when information costs are high. Thus, voluntary cooperation seldom extends to shared control.

Legislative Mandate

To push the linkage a step further, legislative mandates requiring coordination among all relevant agencies exist in most states. These laws require coordinating councils, joint review of plans, and statements of agreement. But it is difficult to spur substantive interaction through legislation alone, because the activities of the agencies and organizations making up the human resource development system tend to be dominated by the professional staffs actually delivering the services. Many of these organizations fit the description of local school systems offered by Richard F. Elmore (1980):

> The system is bottom heavy and loosely coupled. It is bottom heavy because the closer we get to the bottom of the pyramid, the closer we get to the factors that have the greatest effect on the programs' success or failure. It is loosely coupled because the ability of one level to control the behavior of another is weak and largely negative. (p 27)

In such organizations, legislation that requires meetings among agency heads, sharing of plans, and even the production of a joint plan may not induce much coordination. For example, the Commission for Vocational Education in Washington state, which was described earlier, has extensive legal authority to regulate the vocational education system. In spite of considerable effort by the Commission, there is very little interaction among the major state agencies responsible for planning vocational education.

Legislation can most effectively promote direct linkages where a common effort is required to meet a specific problem. However, where specific objectives and the intermediate steps necessary to attain them are not known, the best that can be done is to require instruments for sharing information in the hope that this will induce more voluntary cooperation. A problem sometimes exists because a consistent set of rules requires coordination of federal, state, and local legislation. At the local level, where the services are delivered and much of the actual power resides, there is not much rule-making authority. Yet, it is at the local level where the most effective cooperative arrangements take place.

Legislation may help to provide a more effective system, even when it is not successful at coordinating components of that system, by directly eliminating duplication of effort. For example, in some states a legislative commitment has been made to fund only one source of labor market statistics. This is an important step toward elimination of duplication effort.

Funding or Management Control

The most powerful policy actions to promote linkages and coordination involve changes in funding or management control. These actions change the terms of trade so that voluntary cooperation is either induced or made unnecessary. In many cases, this is more appropriately seen as consolidation rather than coordination. Such action also has costs, however, including the loss of agency independence and competition within the system. It is an advisable step only if the program objectives are clear, and there is an obvious need for more efficient administration.

A short case study of the interaction between the balance-of-state CETA prime sponsor and Employment Security Department (ES) in Washington state illustrates some of the strengths and weaknesses of coordination by management control. From 1973 to 1976, state CETA programs were conducted as a division within the Office of Community Development, where CETA was by far the largest component of that office. During that period, there was constant tension between CETA and ES that centered on duplication of job placement effort and a difference of opinion about the appropriate types of job training.

The first step toward resolution of this conflict occurred in 1977, when CETA was made a division within ES. This move initiated gradual consolidation and coordiantion of activities. A second step occurred when, as a result of some financial problems, the decision was made to put the CETA service centers and the employment services in the same office facilities in some locations in the state. This led to better coordination for program intake and for placement activities.

Even though the first step toward coordination was taken in 1977 when CETA programs were at their peak, the traditional philosophy of the Unemployment Insurance/Employment Security (UI/ES) programs dominated the merged unit. The merger brought the CETA balance-of-state prime sponsor and the administration of the special governor's grant money directly under an old line employment services operation. There was not any immediate major shift in emphasis, but there were some changes that had a long-term impact. A list of positive and negative effects of the merger was compiled from CETA and ES personnel responses to an interview question that asked—

> What, in your opinion, were the effects of bringing CETA programs under the management of the Employment Security Department? (Where useful, compare Washington state with other prime sponsors that are more independent.)

The following are the *positive effects* mentioned by the CETA and ES personnel:

1. Better coordination of CETA services with other job-related services, particularly placement services
2. Better interaction with some other state agencies, especially in vocational education, corrections, and community colleges
3. More complete decentralization of CETA operations to small localities throughout the state
4. Greater emphasis on job placement
5. A smooth, efficient operation
6. An increased ability to avoid being controlled by a few special interest groups

The following are the *negative effects* mentioned:

1. Less imaginative program innovation (The new arrangement was called “a stodgy operation” by one observer)
2. Too much emphasis on job market needs and not enough on the special needs of program participants
3. Lack of coordination with social and health services
4. Too many staff—too much money spent on research, workshops, travel, and not enough on client services
5. Too isolated from the needs of major client groups

While this was not a scientific survey, the results suggest that even though greater interaction of service delivery was attained by the consolidation, it was not without cost. Perhaps the most frequently cited "cost" was a change in the character of CETA services from a client-centered approach to one that was focused on job placement.

Even so, the extent of internal coordination within the Washington Employment Security Department was not as extensive as some people wanted. In 1982, a project was funded to identify and develop coordination models to link CETA training and job development (Wagner-Peyser) activities effectively. The project staff completed a review of CETA and ES staff throughout the state, using questionnaires and on-site interviews. Rather than uncovering some good examples of coordination, the study produced a long list of barriers to cooperation. These included most of those discussed earlier in this paper, such as protection of turf, lack of information, lack of incentive, and perception of different purposes for the two divisions within ES. During the period of the study, funding reductions again forced the Employment Security Department to make an adminstrative reorganization that brought the employees responsible for Wagner-Peyser and CETA activities into the same division within ES and caused them to be housed together in more communities throughout the state. The coordination model that had earlier been sought by the project staff seemed to have developed as a result of budgetary necessity. The study concluded with a recommendation that other CETA prime sponsors seek to establish an "administrative" environment conducive to improving coordination. That is, they recommended greater consolidation.

While centralization through consolidation is an effective means of securing linkage, it involves the sacrifice of separate program identities. Most organizations within the human resource development system have distinct purposes, and consolidation would likely result in the goals of one becoming subordinate to those of another. Discretion and innovation may also be reduced in the process. Consolidation is a powerful tool, to be used only when the costs and benefits have been fully considered.

Bargaining

Looking at formal agency interaction, either on a voluntary basis or as a result of legislative mandate, does little to dispel the notion that the system remains fragmented and unable to respond to new challenges in a consistent way. At the planning level, this is probably an accurate assessment. However, this panorama does not give an accurate picture of local operations. In the local communities there is actually more interaction than at the federal or state level, chiefly because there is less attention to protection of jurisdictional autonomy and more given to the day-to-day problems of making the system work. To make the system function, constant bargaining and trading of one action for another are required. Sometimes this bargaining process leads to formal arrangements, but in most instances it consists of informal arrangements for cooperation to handle a common problem. In the process, creative resolutions of conflicting agency interests are often accomplished.

Inherently, this bargaining process is neither good nor bad. It is merely the way that the local human resource development establishment handles political and practical problems. To illustrate the range of such agreements, a few abbreviated examples (based on real cases) are provided.

A dispute arose between a local office of the Washington Employment Security Department and a suburban CETA prime sponsor concerning who should handle the intake and job placement for CETA-funded trainees. State law required that some of these functions be conducted by ES, but the prime sponsor felt that ES personnel were too unfamiliar with CETA programs and clients to do an effective job. When the dispute was resolved, the Washington Employment Security Department claimed a victory. In fact, a local agreement had been reached that placed CETA staff in the ES office to handle client intake while ES agreed to participate in special placement activities such as "job clubs," which were conducted by outside contractors.

In another case, a local community college with a long history of successful training for CETA participants attempted to charge higher fees for CETA trainees than for their regular students. College staff also wanted more discretion to dismiss problem students. They contended that CETA-eligible students imposed additional costs on them because of the participants' need for additional counseling and more individualized training. The college staff also felt that they should receive more money to handle the red tape associated with their CETA program involvement. However, they did not want to discontinue their contractual arrangement, because CETA was an important revenue source. The local CETA prime sponsor also wished to maintain the existing training arrangement because the college conducted some highly successful programs. But, CETA administrators feared that paying higher fees would set a dangerous precedent. An agreement was reached that some community college personnel would be designated as CETA counselors and their salaries would be paid by the CETA prime sponsors. As in the first case, this solution was of questionable legality and went beyond any coordinating agreements at the state level. It was, however, an arrangement that satisfied both parties and also reduced the CETA participant dropout rate.

A third example suggests that the bargaining process may provide results that are not desirable. In one state, the SOICC office was given the responsibility for promotion and dissemination of OES data without any legislative commitment for continued funding. The system essentially provided information on a user-pay basis. This placed the directors of the SOICC and the OES system in a position of bargaining for funding support. Since they effectively controlled the project, the individual funding agencies were also able to bargain over the types of data to be provided and the priorities for different aspects of the system (i.e., which industries or occupations would be examined first). Although the promises of data for dollars kept the system alive, the development of a general system that would have been most useful for planning was hampered. In the view of many observers, the bargaining process failed because all data users could not be charged equally for use and there was a potential for "free riders."

The interaction between local Private Industry Councils (PICs), CETA prime sponsors, and other local human resource development organizations provides a final example. A review of eight PICs in Washington state and reports of PIC activity gathered in the Princeton field network evaluation of CETA programs suggests that few PICs have been as fully involved in human resource development planning as the authorizing legislation allows. In most cases, private industry representatives have acted only in an advisory capacity and have had very limited program involvement. They have not had sufficient knowledge of the labor market or of human resource development institutions to play a leading role, and there has been little incentive to go much beyond a superficial involvement.* In many areas, a tacit agreement has been made to the effect that the PICs have been given credit for innovations while the human resource development agencies have attempted to design and implement programs that have greater private sector involvement. In this case, the bargaining process is more subtle than in the other examples, but there has clearly been a balancing of conflicting objectives through a trade-off.

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*There have been some notable exceptions to this generalization. They have occurred when a few public-spirited private employers have decided to devote a lot of time and resources to the program.

Is the System Really Chaotic?

Too often, judgments about the extent of coordination in a system are made by assessing the formal connections among the bewildering array of public agencies and private organizations that have overlapping objectives. Such an assessment, whether it be of welfare, jobs training programs, education, law enforcement, or any other public service, usually concludes with a judgment that the system is chaotic. Seen from the local level, however, one is impressed with the network of informal agreements (usually resulting from an extended bargaining process) that establish working rules for the system. Instead of chaos and duplication, there are often local systems with extensive coordination of efforts. The essential requirement for this local coordination is stability of administrative rules and of implementation authority as it affects local service deliverers.

It is almost paradoxical that one threat to this stability comes from continual efforts at the state level to create a more coordinated system. This is especially true where consolidation and management control are pursued. For example, the description (presented earlier) of vocational education in Washington state depicts a loosely coordinated public-private system reporting to a variety of agency heads (e.g., sometimes one vocational institution must report to several bodies, including a local board, a state agency, and a coordinating council). No one would contend that this is an optimal arrangement, but over the many years of its existence, agreements have been reached by the local institutions concerning jurisdiction, curriculum control, funding, and other matters so that the system now functions quite well. Conflicts within the system, which frequently arise, are settled by a continual negotiation process that sets the working rules. Stability comes from the common understanding of how these changes are made.

Presently, there are proposals to reorganize the state vocational education system substantially, putting it more directly under a single authority. In reading the justifications for these proposed actions, there is no evidence that any proposal stems from evidence of coordination problems at the service delivery level. Rather, the real problem is a struggle (bargaining process) among state agencies over the question of jurisdictional control. The immediate outcome of implementing such proposals would be a disruption of the local working rules and possibly the temporary interruption of a locally coordinated system.

CONCLUSION: CAN THE SYSTEM RESPOND TO CHANGING LABOR DEMANDS?

The complete human resource development system in the United States is a curious admixture of planned and unplanned, private and public training. It includes all activities that work toward a better-educated, higher-skilled, more-employable labor force.

We have never had a comprehensive national human resource development plan in this country, and such a process is not needed. For a majority of Americans the market system, aided by publicly supported education, works very well for training and allocating labor resources. By looking at wages and job vacancies as market signals of society's occupational needs, most people make choices that result in satisfactory job matches. At the same time, although there are institutional lags, private and public institutions for education and training do respond to new industrial and occupational demands. The fact that there are notable mismatches of skills and job requirements in some occupations should not overshadow the basic strengths of our system to respond through free choice.

The aim of this discussion of the human resource development system has been focused not on the labor market per se, but on the institutions which attempt to deal with problems in the labor market. The human resource development system is a problem-solving apparatus that, piece by piece, has been established to make the labor market work better, for more people, with shorter lags, and with greater equity. Whether the human resource development system can respond in any meaningful way to changing demands is doubtful. This does not mean, however, that the system is not functioning well.

The impetus for originally creating many components of the system was a supply (rather than a demand) problem, an economic malady characterized by unemployment, poverty, and associated social difficulties. Those afflictions remain with us and may even be getting worse. As suggested earlier, it is unrealistic to imagine that, through a series of linkages among programs, the human resource development system can funnel large numbers of unemployed and unskilled people into the jobs created by the growth of high-technology industries. Among other very difficult tasks, that would require extensive coordination among agencies with vastly different objectives. The best that can be expected is that agencies dealing with the needs of the disadvantaged will succeed in upgrading the skills of some of their clientele to a point where they can respond to job market needs.

Attempts to link the private sector more directly to the human resource development system will probably also have limited success. For this to improve, there would either have to be a technological revolution that would result in shortages of semiskilled labor (the opposite of what most analysts are predicting), or labor supply agencies would have to drop their commitment to the disadvantaged. In that case, the agencies would become an extension of our public schools. Tax incentive programs for private industry may have a marginal impact by altering labor skill requirements, but this is unlikely to induce the creation of major programs to train the unskilled to fill highly skilled jobs.

Parts of the system do respond directly to new skill demands. The changing labor demands are creating a massive response in private and public universities. There is a major expansion of program and course offerings in computer science, engineering, operations research, and communications. Many universities are developing new interdisciplinary programs in "technology." But this is largely a reaction to market signals and student demands, rather than an outcome of forecasting and planning.

Given that there are things that the human resource development system cannot and should not do, is there sufficient coordination and linkage within the system? Should improvements be made, and if so, which ones and how? The following conclusions offer suggestions for how to answer these questions.

- While program duplication is sometimes warranted, the accumulation and dissemination of labor market information for planning should be centralized or strictly coordinated. Duplication in this function almost certainly leads to waste and may result in fragmented effort. Agencies in most areas are now moving toward the use of a common data base.

- What may appear to be a fragmented human resource development system when looking at legislation and formal agreements may be a well-coordinated process at the local level. Proposals to integrate programs or to require greater coordination should only be considered when they are accompanied by a description of how the system operates locally.

- Many of the difficulties attributed to lack of coordination are actually a result of unrealistic expectations and limited resources. The failure of many training institutions to prepare trainees for new occupations is an example. At present, there is an unhealthy combination of rising expectations and reduced funding for such programs.

- Promotion of coordination among local programs requires a stable administrative structure and enough local discretion to develop unorthodox solutions to conflicts as they arise.

- Where there are no major conflicts in objectives, consolidation is an effective way to attain coordination. This has the added advantage of making a single agency responsible for the eventual program outcome. Too much time is wasted trying to coordinate the efforts of public agencies that may be combined.

- Job placement should remain decentralized and unlinked. Programs with the highest rates of placement, even after controlling for client characteristics, are those that have placement responsibility. Their training focus is job related, and they tend to develop informal ties with private industry that are among the best linkages in the system. In the case of placement, moving toward specialization by function and requiring more coordination are steps in the wrong direction.

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JACK A. MEYER

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State and Local Adjustments: Reactor Comments

THE NEED FOR A BROADER SCOPE

My principal concern about the chapter by V. Lane Rawlins is that it seems to adopt a rather restrictive view of the subject matter—coordination and linking efforts among employment and training programs. Rawlins focuses primarily on coordination among various public programs and pays scant attention to the increasingly important and diverse linkages between public institutions and the private sector.

Rawlins is not necessarily to be faulted for concentrating on the area he knows best—programs run by government agencies—as he is to be encouraged to expand his horizons in future work to encompass features of the employment and training landscape that have been largely obscured from view in this paper. In any event, his work should take note of the broader terrain, and at least encourage others to study the linkages that cut across the private-public boundary.

Rawlins presents useful and interesting arguments suggesting that more coordination and more information do not always lead to more successful outcomes. He wisely warns that concentrating on cooperation among state or federal agencies that are remote from local community settings can achieve a hollow victory in the form of highly structured, formal agreements that fail to translate into local action. Meanwhile, the more genuine cooperation at the local level often occurs without much fanfare or structure. Rawlins seems to be prudently counseling us to pay less attention to the form and more to the substance of coordination.

My concern with his analysis is that it focuses mainly on coordination among agencies within the public employment and training field. Little attention is paid to the substantial growth in private sector investment in education and training. My colleagues Denis Doyle and Marsha Levine (1982) have noted that this upturn in private investment began well before government spending reductions were planned. They report that the American Society for Training and Development has estimated the amount of money invested by business in education and training to be $30 billion (p. 272-329). Doyle and Levine additionally describe three main aspects of the growth in private investment in human capital, as it is called—the growth of private elementary and secondary education, the direct provision of education and training by business, and a wide variety of partnerships between business and traditional educational institutions.

With regard to private schools, Doyle and Levine attempt to shatter some of the mythology that has led to an unnecessarily negative view of their usefulness. This theme is stressed appropriately by David W. Stevens in his chapter of this book, which correctly suggests that

> at least some reasons, which have been offered in the past, why proprietary schools cannot be counted on to participate in anticipatory human resource development investments are not sustainable. Both careful theoretical examination and existing evidence suggest just the opposite: Proprietary institutions have been, and can be expected to continue to be willing partners in offering training in anticipation of attracting appropriate employment opportunities to absorb the trainees.

Doyle and Levine document and describe such programs as the Xerox International Center for Training and Management Development in Leesburg, Virginia, which provides education and training in sales, service, and management development for Xerox employees; the AT&T program that has about fourteen thousand employees who, at any given time, are taking courses in basic mathematics and writing on company time; university-corporate alliances, such as M.I.T. and Exxon in combustion research and Dupont and Harvard Medical School in genetic engineering; partnerships between industry and precollegiate educational institutions such as Kaiser Aluminum and Chemical Company's contribution of 100 volunteers and over four hundred thousand dollars in the last three years to establish reading, career, and mathematics centers; and magnet schools in engineering and health professions developed in Houston with business and university support (Levine and Doyle 1982, pp. 389-411).

Another aspect of industry involvement in the education and training of the work force involves the growing importance of private industry councils (PICs) under CETA. While many of the PICs are still in a formative stage, others are serving a useful function. More important, PICs are given much more responsibility and authority under legislation to extend CETA that is currently working its way through Congress. In this sense, it is premature to draw definitive conclusions about PICs from the spotty record on their developmental stage of the past few years. Thus, Rawlins' observation that PICs "have not revolutionized the manpower system, as the 1978 Amendments to CETA suggested they would" appears to be based on unrealistic expectations.

BETTER OCCUPATIONAL INFORMATION

I agree with Rawlins' concern about the need for better occupational information and skill demand forecasts. I was somewhat puzzled (and unconvinced) by Stevens' argument that we should not be too concerned about the deficiencies in the quality of information because, in his view, better information might not make as much of a difference in actual outcomes as we hope it would. Stevens' argument seems to imply that social investment in better data and forecasts could be wasteful because we would still be blocked by *other* barriers to successful education and training outcomes. But he is quite vague about the nature of those other barriers. Stevens seems too willing to jump from the deficiencies of current occupational employment forecasts to what seems like a resigned determination to plunge ahead since better information would not matter much anyway. He makes only a passing reference to staff assignments and enrollee accrual of credit hours as the "other barriers," but does not tell us how these practices block a useful course.

THE DESIRABILITY OF AN INTEGRATED NETWORK OF JOB-RELATED ASSISTANCE

One of the key ingredients of successful models of intervention in job-related assistance seems to be the integration of labor market

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information, job readiness, skill training, job placement, and follow-up tracking to foster job retention. Private sector organizations with successful records in placing and retaining people in lasting jobs are often "vertically integrated." These groups find candidates, evaluate their job readiness and motivation, impart knowledge of the world of work, obtain jobs, and follow through after the initial placement.

The Rawlins chapter appears to miss this point and seems inclined toward a separation of functions and division of labor. This may reflect the tendency noted above to focus the analysis too heavily on public agencies, which are too often artifically divided. One agency or bureau plans; another assesses needs; and third works on placement. Successful private sector programs often transcend these boundaries.

THE ROLE OF GOVERNMENT

I would like to see both authors be more explicit about the proper role of government in employment and training programs. We are going through a period of adjustment and change in which such programs as public service employment are being set aside, and publicly supported job training are being focused on the very poor (mainly welfare recipients and youth), but without providing stipends. Government is placing more emphasis now on entrepreneurial development in inner-city areas and tax credits for business locating in such areas.

It was not clear, for example, from Rawlins' very brief discussion of such programs as the Targeted Jobs Tax Credits (TJTC), PICs, or the U.S. Employment Service what specific role he envisioned for the government, or what alternatives he would suggest where such programs were believed to be of limited value. A similar impression pertains to Stevens' discussion of the fear that state industrial policies could make the rich richer by making the poor poorer. I doubt that he would cheer or advocate policies amounting to a zero sum game, but he raised the concern without providing any clear-cut sense of needed direction. The same lack of policy conclusions can be found in Stevens' discussion of the "pulsation" phenomenon. Is he suggesting that we not subsidize these industries? What are the criteria for allocating scarce public dollars among competing needs, regions, or target groups?

In general, I think that both of the chapters reviewed here would benefit from more thought about policy implications and conclusions.

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HAROLD STARR

Vocational Education's Response to Skilled Industrial Worker Shortages

INTRODUCTION

Recent concerns about the state and fate of the nation's industrial base and defense preparedness in the 1980s and beyond have stimulated a national interest in skilled worker shortages and the ability of training agencies to respond. Much testimony has been presented before Congress to the effect that (1) shortages of skilled workers in industrially oriented occupations are having or will have an adverse effect in coming years on output in both the civilian and domestic defense industry sectors of the economy and (2) these effects are likely to be intensified in the future unless appropriate training programs are implemented or expanded, especially at the postsecondary and university level (U.S. House of Representatives 1980, 1982; U.S. Congress 1982; American Electronics Associations 1981).

Most of the testimony centered around a small group of occupations that are believed to be experiencing growing shortages of skilled workers. These occupations can be characterized as requiring relatively long training periods, as requiring skills and aptitudes not widely

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distributed in the population, and as being not easily relieved by raising wages. Furthermore, shortages of workers in these occupations can be expected to affect adversely the nation's output of basic products and services as opposed to having a strictly local consequence (Ruff et al. 1981).

Occupations of this type were described in congressional testimony as including the skilled machining trades, electrical and electronics engineer, electronics technician, and computer scientist. Concern in this testimony was also expressed for the need for upgrading already skilled workers in light of new technologies and production techniques.

It is likely that if significant industrial recovery and expansion in defense industry contracting occur rapidly, shortages of skilled workers in a wide range of industrially oriented craft and technical occupations could occur. Electronics technicians and computer programmers are frequently mentioned in this connection. Health-related occupations, especially nursing and laboratory technicians, have been mentioned in the literature as being skilled worker occupations having shortages; but shortages in these occupations would not materially affect industrial expansion.

There are several reasons for assuming that shortages of skilled workers will be with us in the future. First, the United States labor force is expected to increase anywhere from 17 to 25 percent between 1980 and 1990 (Pilot 1982, p. 46). Accompanying an evident need for new workers will be a decline in the United States birthrate, which will result in fewer younger workers being available to enter the work force (Flaim and Fullerton 1979). Second, the need to become more profitable and competitive has caused, and may continue to influence, production-oriented industries to relocate, while other plants have shut down or reduced their skilled labor requirements in the face of unfavorable economic conditions.

Although new employment opportunities for unemployed skilled workers may exist at some distance from where they reside, many skilled workers find it too difficult to relocate to new job sites. The result has been that the number of skilled workers remains the same but that these workers are not necessarily available for employment where and when they are needed.* This last situation is one factor that has prompted the majority of states to involve the state vocational education agency in programs of customized training to meet skill training needs of specific firms (Bottoms 1982; Brant 1982; Burdette 1982).

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*The large number of permanantly dislocated skilled workers as a result of plant closings and relocations will only be partially resolved by implementation of Title III of the recently enacted Job Training Partnership Act of 1982. Title III deals with retraining and provides for a limited relocation program for affected workers.

Third, there is likely to be a potential for shortages in certain skilled occupations unless the recent trend in employment away from production toward the service industries and occupations is reversed. Fourth, a strong economic recovery accompanied by industrial expansion and modernization may create short-term supply-demand imbalances and create a need for expanded training initiatives to turn out new skilled workers and to upgrade the skills of existing workers.

The current administration in Washington proposes to increase defense expenditures substantially. If the Congress goes along with the administration's requests, the bulk of increased defense expenditures is likely to go to the development and production of defense goods and services by the defense industrial base of the nation (Personick 1981). In response to the likelihood that defense preparedness expenditures will have an impact on the defense industrial base, the U.S. Department of Defense has commissioned a study to explore the consequences of alternative defense spending scenarios on key industrial sectors and needs for skilled labor (Blond 1981; Brown and Doggett 1981). This study suggests that skilled labor needs of the defense industrial base are likely to be met. However, the achievement of the objective can be expected to have implications for the supply of skilled workers in nondefense industries and for education and training programs. Brown and Doggett point out that:

> In virtually all circumstances, the defense components of output and employment should be able to be met if effective management exists to transfer resources and broaden the base within industry and occupational groups which can be targeted to the defense component of overall demand. To achieve this same objective without impacting on non-defense output, however, will require that significant increases in employment within particular industries and occupational groups be achieved, often implying the need to bring additional skilled and trained personnel into the base. These requirements are most frequently noted in the skilled blue collar labor categories. Meeting such a requirement will imply a reversal of the recent trends in employment away from production towards the service industries and occupations. The

> implications of expanding the employment base of production workers extend in important ways into the educational and training programs operating within the nation. Like the capital investment requirements implied by the higher defense spending plans, this transition involves many uncertainties and will certainly require the attention of planners and managers in both government and the private sector (p. 19).

Purpose and Direction of the Study

This study was conducted to determine how state and local vocational education agencies and institutions responded to presumed shortages of skilled, industrially oriented craftsworkers and technicians since the mid-1970s. These insights would then serve as a basis for suggesting ways of improving that responsiveness in the 1980s and beyond.

To arrive at these insights, the issue of shortages of skilled workers was examined along with indicators of the responsiveness of vocational education since the mid-1970s in providing the kinds of training that address these shortages. Implications of the findings and suggestions for improving the level of responsiveness of state and local vocational education in the 1980s and beyond are presented for consideration by policymakers and vocational education administrators.

Approach and Limitations of the Findings

The provision of vocational education is based on a state-local partnership. This chapter separately examines the contribution of each partner in responding to shortages of skilled industrial workers. Local schools initiate programs and provide opportunities for training. They respond to local employers' needs and students' interests. State vocational education agencies, on the other hand, have an interest in seeing that the aggregate of local programs is responsive to broader statewide economic and social needs. They respond by showing an awareness of training needs, prioritizing these needs, informing local providers of the broader state needs, and collaborating with them to achieve a balance between these state needs and local training concerns. An analysis of the responsiveness of the vocational education system to any training issue therefore requires an examination of the contribution of each partner.

The strategy used in this study was to examine extant data bases. Limitations in time and/or resources prevented the inclusion of other techniques (e.g., questionnaires, on-site data collection, interviews) for determining the responsiveness of vocational education in dealing with skilled labor shortages. The findings presented in this chapter are limited, therefore, by the technique used for analyzing the responsiveness of vocational education and any inherent limitations in the particular data bases selected for analysis purposes.

Because of present economic circumstances, there are now large numbers of skilled, industrially oriented craftsworkers and technicians who are unemployed. This chapter assumes that this situation is a temporary one and that shortages of such workers will prevail in the 1980s and beyond for reasons touched upon in the text of the report.

VOCATIONAL EDUCATION'S RESPONSIVENESS

What Occupations Qualify for Analysis?

A search of the literature was performed to obtain information about the extent of shortages of skilled, industrially oriented craftsworkers and technicians. Those occupations experiencing the greatest shortages of available workers would then be used in the analysis of vocational education's responsiveness. It soon became obvious that quantitative estimates of shortages in the supply of industrially oriented craftsworkers and technicians were not available.

The most adequately documented shortages seemed to be in the skilled machining trades. Since the skilled machining trades qualify as having shortages of skilled workers that are likely to affect efforts at reindustrialization and military preparedness, this group of occupations will receive a special emphasis in the analysis that follows. Evidence to support the assertion that skilled machining trades have been experiencing severe shortages of skilled workers and are likely to continue to experience these shortages is presented next.

Industry groups, such as the Task Force on Skilled Trades Shortages and the National Tooling and Machining Association; trade journals, such as Chilton's *Iron Age* (Bowers 1977; Barks 1979; Greene 1980); and U.S. Department of Labor staff persons Kutscher (1982) and Rosenthal (1982) all concur that national labor shortages in the skilled machining trades occupations are real, even if the extent of the shortages is not presently quantifiable.

The Task Force on Skilled Trades Shortages is a coalition of trade organizations representing thirty-two thousand plants employing 1 million persons nationwide. According to a recent publication of the Task Force (1981), its membership is troubled by "the critical shortage of skilled workers in mold making, tool making, precision machining and other specialized metal working positions. . ." (p. 1). Although unable to substantiate the full scope of such shortages, the Task Force believes that "available figures show a serious imbalance between job openings and qualified prospects available to fill positions" (p. 2).

A more evidence-based argument for presuming that critical national skilled labor shortages exist in the skilled machining trades has been made by the National Tooling and Machining Association (1982). This association is composed of thirty-seven hundred member companies comprising about one-fourth of the approximately fourteen thousand American companies in the machining trades job-shop industry. The National Tooling and Machining Association recently undertook a survey of its membership to document the extent of skilled labor shortages among its members. The Association reported that:

> The typical respondent said that an additional 2.3 journeymen would be hired immediately (under current business conditions) if available, and that a total of 5.3 additional journeymen would be hired if available under ideal business conditions (at present levels of plant and equipment). . . . This represented a desire of these firms to expand their journeyman workforce by 50 percent. (pp. 8-9)

The Association cautions that it is "highly unlikely that even if 32,000 journeymen suddenly became available to work in job shops (member and non-member) that the work force would grow by that number" (p. 10).

Admitting that there are numerous shortcomings in studies designed to quantify the extent of labor shortages in the skilled machining trades by surveying employers, the National Tooling and Machining Association provides five other kinds of empirical evidence for assuming that shortages of skilled machining trades workers are critical, national ones in the sense used in this chapter:

- Extended lead times for deliveries of most engineered products.

- Classified newspaper employment advertisements in most industrial cities in the U.S. still show demand for these workers, despite a sluggish economy.

- Wage rates for some individuals in these trades exceed $20/hour in some parts of the country.

- Journeyman-level workers in these trades usually have plenty of opportunity for overtime, and 50-hour weeks are not unusual, even in relatively slow periods.

- Employment agencies have sprung up which specialize in recruiting skilled machining trades workers from outside the U.S. and some employers make regular trips abroad to recruit skilled machinists, toolmakers, diemakers, modelmakers and other specialists that aren't available at home. (p.2)

The findings of Kutscher (1982) and Rosenthal (1982) lend further substantiation for the belief that skilled machining trades are experiencing critical, national labor shortages in the sense defined in this chapter. Kutscher summarizes evidence about the extent of shortages of job and die setters, tool and die makers, and machinists (skilled occupations) and machine operators (skilled and semiskilled occupations) this way:

> Only in the skilled category was there an appreciable increase in employment throughout the past decade. (p.11)
>
> . . . information about the job market for skilled machining workers during the 1970s is consistent with the existance of shortages. . . . However, statistics generated by ongoing data collection programs do not provide information necessary to quantify the shortage. . . . the severity of the shortages varies among geographical areas. (p.13)

Taking all available information into consideration about the extent of shortages in skilled machining occupations, Rosenthal concludes that:

> During the past few years many articles dealing with current and expected future shortages of machinists were published in national periodicals. Their basic conclusions were generally consistent: Employers currently are not able to hire as many skilled machinists as they would like; current training is not sufficient to

> alleviate shortages; and similar conditions have existed for some time. Concern about the future supply is also based on the expected decline in the number of 18 to 24-year-old workers in the 1980's. However, different conclusions result from studies concerning technological change. They generally state that the need for manual labor in factories, especially highly skilled machinists, will be reduced significantly in the future.
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> Because of the different viewpoints of these studies, future supply-demand conditions for machinists are unclear. Furthermore, very little of the statistical information used to present both sides is based on "hard data." (p. 31)

Rosenthal uses data regarding wages and unemployment to support the idea that there is a real shortage of workers in the skilled machining trades. He notes that in the period 1972 through 1980, wages did not seem to overcome the expressed needs of employers for workers in the skilled machining trades. For example:

> Workers in the machining occupations covered in the BLS Area Wage Surveys had higher, average hourly earnings than all production workers in the manufacturing industries in the same city as reported in the Bureau's current Employment Statistics program. (p.33)

Rosenthal also presents evidence indicating that unemployment rates for machinists and tool and die makers were lower than those for craftsworkers as a whole in each year from 1972 to 1980.

Electronics technicians and electrical engineers also seemed to qualify as industrially oriented skilled occupations having shortages, based on evidence assembled by the American Electronics Association (1981). However, these occupations were not considered appropriate for inclusion in the analysis of vocational education's responsiveness. Electrical engineers require a college degree; and there did not seem to be a sufficiently broad array of evidence concerning electronics technicians (as was presented for the machining trades) on which to base an assumption that shortages were and would continue to be severe.

One difficulty in identifying skilled occupations that are experiencing shortages, at least at this point in time, is that current levels of unemployment and the presence of many unemployed skilled workers mask the probable existence of long-term supply-demand imbalances, or obscure understanding of how changing production technologies might require skilled workers to learn new skills if they are to be adequately productive.*In addition, the supply of skilled workers in a particular occupation who are available for employment because of the effects of plant relocations or shutdowns cannot be used as an accurate index of true supply available for employment, since many of these workers are older and/or are not in a position to relocate to new job sites.

FINDINGS

In assessing the responsiveness of vocational education to shortages of industrially oriented skilled craftsworkers and technicians since the mid-1970s, several lines of evidence were pursued. First, state plans and annual program plans for vocational education were examined to determine what policy and planning initiatives state-level vocational education agencies had in place with respect to shortages of skilled, industrially oriented labor. The employment data provided to state agencies for vocational education by their state employment services agencies were also examined—in this case, to determine whether the state employment services agencies had sensitized their state vocational education agencies to the existence of shortages of skilled, industrially oriented labor. Second, national vocational education enrollment data were analyzed to determine whether the demands of students for training opportunities, which often reflect changing opportunities for employment, were responded to by local providers of vocational education. In this instance, the analysis was limited by the fact that the data used, although the best available, were not recent.

State Plans for Vocational Education

State plans for vocational education were considered a logical source of information about the intentions of state boards and agencies for vocational education to respond to shortages of skilled workers (at least in 1978). State plans represent assessments of state employment needs by state boards and agencies for vocational education and

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*See Michael J. Piore, The Crises of Industrial Capitalism and the Creation of a New Economic Order, for a discussion of how increasing trends toward batch production as opposed to mass production computer-based technologies are likely to create a need for more highly skilled craftsworkers.

statements of their intentions to meet the identified employment needs through various planning and policy initiatives. The contents of state plans also serve as a vehicle for identifying where state vocational education agencies obtain their awareness of shortages of skilled workers.

State plans for vocational education from the fifty states and the Commonwealth of Puerto Rico were included in the assessment process. These plans, as required by the Education Amendments of 1976 and the accompanying Rules and Regulations for Vocational Education State Programs and Commissioner's Discretionary Programs, were first prepared in 1978.

The Amendments and Rules and Regulations direct the state boards for vocational education or their designated agencies (the state vocational education agencies) to use funds available to them to support instructional programs that are consistent with available employment opportunities. To achieve this objective, the states are directed to use the latest and most accurate employment data to assess current and future needs for workers and job skills within the state and, where appropriate, the pertinent region of the country. These employment data are to be used by state boards for vocational education as a major basis for formulating long-range and annual program and enrollment goals for the state's vocational education system. The state plans are also to describe how funds will be allocated to meet identified employment needs and the reasons for making these funding decisions.

The contents of the state plans were examined, with particular attention given to determining if states used shortages of skilled machining trades workers and/or other kinds of skilled labor in developing their rationale for program goals. And, if any kinds of skilled labor shortages were described in state plans, efforts were made to determine if specific planning and policy initiatives were described that might ensure that these employment needs would be met.*

There was a noticeable absence of specific references to skilled labor shortages as a basis for formulated program goals in the state plans that were researched. In thirty-one of the state plans, it was not possible to determine clear relationships among program and enrollment goals, funding decisions, and employment needs. There was such a relationship in twelve state plans, but it was based on estimated needs for workers resulting from occupational growth requirements *and not because of estimated shortages in the supply of skilled workers to fill job openings.* In these cases, employment needs were assessed without balancing "demand" with supply considerations. In the remaining eight state plans, estimated net employment demand less the projected net employment supply of institutionally trained workers for various occupations was used to support relationships among program and enrollment goals, funding decisions, and employment needs.

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*State plans are complex documents. As a result, study staff may, in a few instances, have overlooked comments indicating that a state agency identified or addressed skill shortages; or, the contents may have failed to communicate the actual state of affairs. Even if this is the case, the essential findings would not be altered. This caveat with regard to state plans also holds true for the annual program plans and published employment data that were examined.

The eight states that used supply estimates of trained workers came closest to relating their programming and allocation decisions to actual or potential labor shortages. But even here, the relationship did not always seem to be a clear one. The state plans of these eight states did not appear to describe the relative magnitude of any supply-demand imbalances for skilled labor, the potential impact of such shortages, or the relative contribution of noninstitutionally trained persons to the estimate of the supply available to meet employers' needs.

In none of the fifty-one state plans examined were skilled machining trades or other occupations that were experiencing shortages of skilled workers identified or prioritized as such. It follows that, since shortages of skilled workers in occupations were not identified in the state plans reviewed, descriptions of planning and policy initiatives to deal with such shortages were also not uncovered.

States did comply with federal requirements by approving local applications for federal funds for individual programs only if local applicants could show local employment opportunities or if the best employment data available at the state level justified offering the applied-for program. The problem with using this best available employment data at the state level was that it usually consisted of employment growth projections rather than supply-demand gaps. Certainly one cannot fault state vocational education agencies for this situation or for using the data available to them as best they could. Local schools, on the other hand, could be responsive to local labor needs by addressing some employers' needs but might or might not specifically address needs for skilled, industrially oriented craftsworkers and technicians, even if such needs exist.

Annual Program Plans for Vocational Education

Annual program plans for vocational education from the fifty states and the Commonwealth of Puerto Rico for fiscal years 1979, 1980, and 1981 were also included as part of the document base. However, only a few fiscal year 1981 annual program plans were available for review, as most of these plans had not been released for distribution by the states at the time of the document base analysis.

Under the provisions for annual program plans in the Education Amendments of 1976, the states are required to modify the assessment of employment needs reported in the state plan for vocational education if later or more accurate employment data have been made available to the state boards for vocational education or their designated administrative agencies. If the original assessment of employment needs is modified, then the states are required to modify their original program and enrollment goals accordingly.

The contents of the annual program plans were examined and, as in the case of state plans, particular attention was given to determining how many states emphasized skilled labor shortages. Again, as in the examination of state plans, efforts were made to determine if specific planning and policy initiatives were described to deal with identified skilled labor shortages. Finally, whenever annual plans described skilled labor shortages, the source of information about the shortage were identified and recorded.

The identification of skilled labor shortages was found in one or more of the annual program plans of eight states. In five of the eight states (New Hampshire, Oklahoma, South Carolina, Tennessee, and Vermont), shortages of skilled machining trades workers were reported in one or more annual program plans. Three of these five states also reported shortages of other kinds of skilled labor (i.e., other kinds of craftsworkers, technicians, and nursing and allied health workers). Two other states, Massachusetts and Mississippi, identified skilled labor shortages in occupations other than the machining trades; while Kansas, the eighth state, identified a shortage of nonskilled workers in one or more of its annual program plans.

The eight state boards and agencies for vocational education responded to identified skilled labor shortages in at least two ways: (1) informing local applicants for federal vocational education funds that programs intended to prepare persons for such shortage occupations would in some way be given a preference in the program approval and allocation processes of the state and (2) indicating that local applicants should consider shortage occupations in planning local vocational education programs.

Of the five states indicating worker shortages in the skilled machining trades, two of them, Oklahoma and South Carolina, reported that these shortages were identified by one or more local offices of the state employment services agency. Tennessee indicated its sources of information about skilled labor shortages as employer groups. Vermont and New Hampshire did not list the source of their information about skilled labor shortages.

Interestingly, the sources of information about skilled labor shortages were never reported as being the state advisory council for vocational education, the state plan group, or the State Occupational Information Coordinating Committee. Although none of these three entities has the mandated responsibility of identifying such shortages, these groups could have an indirect role to play in this regard in the future by virtue of either their employer representation or their concern for the coordination of employment information for skill training purposes. The results of the examination of annual program plans are summarized in table 15-1.

Published Employment Data

Employment data publications that are prepared by state employment services agencies and made available to state vocational education agencies represent "official" information about skilled labor shortages. It was the intent of Congress, in its enactment of the Education Amendments of 1976, that state boards and agencies for vocational education should secure the latest and most accurate employment data that are available and use them in preparing state plans and annual program plans for vocational education. Congress expected each state board and agency to secure the latest and most accurate employment data from the state employment services agency, the U.S. Department of Labor, and the National Occupational Information Coordinating Committee. Since the Education Amendments of 1976 emphasize that state boards for vocational education should consider state (and, where appropriate, regional) employment needs, state employment services agencies become the most logical "official" source of employment data for state vocational

TABLE 15-1
TYPES OF SKILL SHORTAGES AS REPORTED IN ANNUAL PROGRAM PLANS

SOURCE State Plan/ Annual Program Plan	TYPES OF SKILL SHORTAGE					SOURCES OF INFORMATION ABOUT SKILL SHORTAGES			
	Machining Trades	Other Crafts-workers	Technicians	Nursing, Allied Health	Other Occupations (nonskilled)	Local Office of State Employment Services Agency	Employer Group	Other Source	Not Indicated
Kansas					●	●			
Massachusetts			●				●		
Mississippi				●					●
New Hampshire	●		●						●
Oklahoma	●				●	●			
S. Carolina	●	●	●	●		●			
Tennessee	●	●	●				●		
Vermont	●			●					●

education planning purposes. In examining employment data publications of the state employment services agencies that are made available to state vocational education agencies, an effort was made to determine whether these publications emphasized the existence of *shortages* of skilled workers and in what occupations.

Published employment information was obtained from forty-nine state employment services agencies. An examination of these publications revealed that six such agencies *explicitly* identified employers' needs for skilled workers by occupation. These agencies were in the states of Georgia, Indiana, North Carolina, Ohio, Texas, and Wisconsin. All of these states, except Texas, indicated shortages of skilled machining trades workers. All six agencies indicated shortages of skilled nursing and allied health workers. Four of the six (those in Indiana, North Carolina, Ohio, and Wisconsin) indicated shortages of industrially oriented technicians. Two of the six (in Indiana and North Carolina) indicated shortages in skilled craft occupations other than the skilled machining trades. The findings of the review of state employment services agency publications are summarized in table 15-2.

It is interesting to note that labor shortages in the skilled machining trades were not reported in either state plans, annual program plans, or state employment services agency publications of many of the large industrial states where such shortages might be expected to exist.

National Vocational Education Enrollment Data

Postsecondary-level enrollment trends were used as a quantitative indicator of vocational education's responsiveness to skilled labor shortages.* Postsecondary-level program completion, placement, and follow-up trends would be more satisfactory indicators. However, nationally available data for the school years that were used in the analysis did not separate postsecondary-level completions from those at the secondary level.

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*National vocational education enrollment and completion data represent imprecise data. Unfortunately, the degree of imprecision for individual programs (and consequently for national totals) and for different years is unknown. Consequently, the findings presented in this chapter that are derived from national enrollment need to be examined with this caveat in mind.

TABLE 15-2
TYPES OF SKILL SHORTAGES AS REPORTED BY STATE EMPLOYMENT SERVICES AGENCIES

SOURCE State Employment Services Agency	TYPES OF SKILL SHORTAGE				
	Machining Trades	Other Craftsworkers	Technicians	Nursing, Allied Health	Other Occupations
Georgia	●			●	●
Indiana	●	●	●	●	●
N. Carolina	●	●	●	●	●
Ohio	●		●	●	
Texas				●	
Wisconsin	●		●	●	●

Secondary school data were not used in the analysis and assessment. This is because when we speak of skilled workers in this chapter, by definition, it implies a level of skill training that is more typically found at the postsecondary level.

The state plan and annual program plan document bases spanned the time period of 1978 through early 1982. It would have been desirable to have enrollment data that spanned the same time period. However, as explained next, this was not possible and compromises had to be made.

Postsecondary vocational education enrollment data for school years 1974-75 through 1978-79 were used in the assessment process. National enrollment data for the 1979-80 and 1980-81 school years were not available. For the four school years 1974-75 through 1977-78, the states reported program, enrollment, and fiscal data using essentially the same format, instructional program codes, and directions for completing reports for transmission to the then U.S. Office of Education. Although program and enrollment data are available for earlier years, a somewhat different coding system was used to identify instructional programs. Also, the coding system in effect for the school years prior to 1974-75 did not account for some of the occupations of concern in the assessment.

The school year 1977-78 represents the last year in which vocational education program and enrollment data were collected from the states under the direction of the U.S. Office of Education. Beginning in the school year 1978-79, the responsibility for collecting program and enrollment data was shifted to the National Center for Education Statistics as mandated by the Education Amendments of 1976. The Education Amendments of 1976 also established a new system for states to report program and enrollment data to the federal government. This system is the Vocational Education Data and Reporting System (VEDS). The first reporting of programs and enrollments under VEDS occurred in 1979. However, definitions of instructional programs, enrollments, and completions were not consistent with the reporting system in place prior to VEDS.

For purposes of analyzing trends and making comparisons of enrollments in vocational education instructional programs, two sets of enrollment data were used. The first set was for school years 1974-75 through 1977-78. The second set included the first year of data (school year 1978-79) reported under VEDS.

The first set of enrollment data (school years 1974-75 through 1977-78) was directly comparable in that the reporting for each of the four years used the same set of instructions, codes, and the like. However, these data did not span any of the years covered by the state plans and annual program plans. The 1978-79 VEDS data did at least help in this regard; although, as already mentioned, its coding structure, definitions, and the like differed from the preceding reporting system. Thus, neither of the two sets of enrollment data used to analyze and compare enrollment trends in vocational education programs was considered as ideal. As it turned out, the findings that are reported next about enrollment trends in vocational education were essentially the same regardless of which of the two sets of enrollment data was used for analysis purposes.

Responsiveness to Skilled Machining Trades Labor Shortages

The list of instructional program titles and codes for reporting vocational education enrollments contains three titles and codes that are used to report enrollments of persons preparing to qualify themselves or to upgrade their existing skills in the machining trades. These three titles and codes are Machine Shop (17.2302), Machine Tool Operation (17.2303), and Tool and Die Making (17.2307).

Two of these programs, Machine Shop and Machine Tool Operation, are not occupationally specific. Also, one cannot be certain about the skill level of the training offered in these programs. In order to use the national enrollment data that are available for these two programs, an assumption was made that some unknown but relatively stable proportion of the Machine Shop and Machine Tool Operation programs are devoted to the training of skilled machining trades workers.

Postsecondary, adult, and apprenticeship enrollments were combined to represent a single postsecondary enrollment count because (1) there was no way to differentiate the program content, skill levels of training, or duration of training within or between the programs offered at the postsecondary and adult levels and through apprenticeship-related training and (2) apprenticeship data were sometimes reported separately and sometimes not.

Figures 15-1 through 15-4 depict various comparisons among rates of growth in program enrollments between 1974-75 and 1977-78 (data set 1). An examination of figures 15-1 through 15-4 reveals that the rate of growth in enrollments for the three machining trades-related programs was—

- slightly greater than for other industrially oriented trade and industrial education programs, and slightly more than double the rate for nonindustrially oriented trade and industrial education programs;
- more than four times greater than for industrially oriented technical education programs;
- equal to that of the health occupations program field; and
- substantially greater than the growth rates in enrollments for office education, distributive education, agricultural education, and consumer and homemaking education (occupational preparation) program fields.

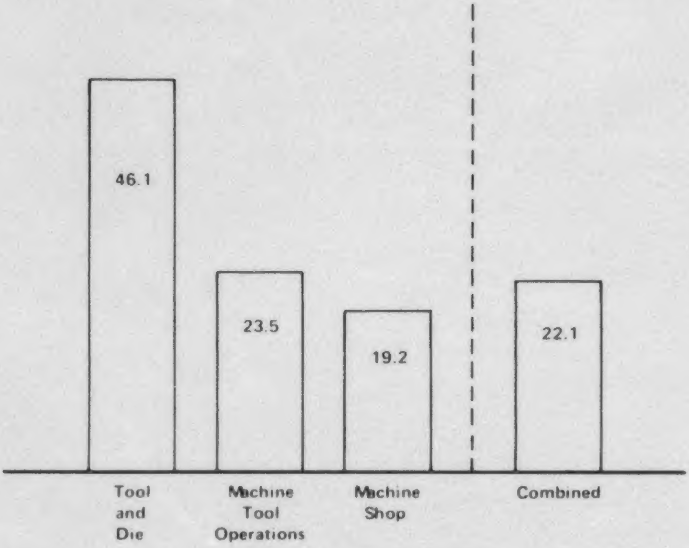

Figure 15-1. Comparative rates of growth for 1974-1975 — 1977-1978 in machining trades-related programs

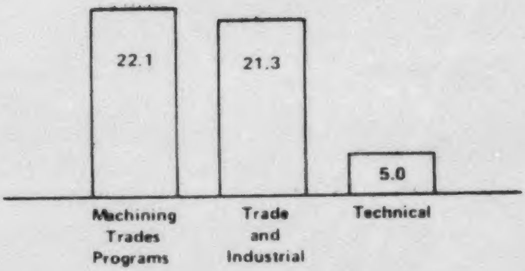

Figure 15-2. Comparative rates of growth for 1974-1975 — 1977-1978 in industrially oriented programs

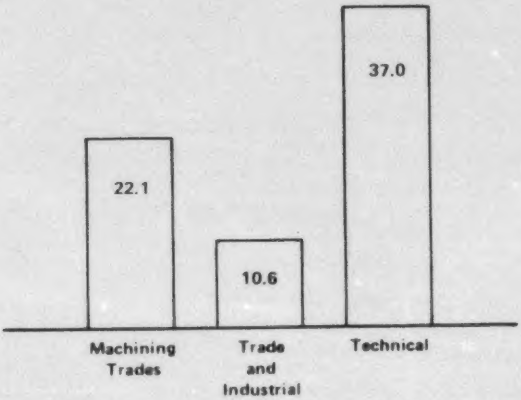

Figure 15-3. Comparative rates of growth for 1974-1975 — 1977-1978 in nonindustrially oriented programs

The comparison of the rates of growth in postsecondary enrollments depicted in figures 15-1 through 15-4 suggests that *local postsecondary vocational education agencies and institutions did, by design or because of student interest, respond to the national need for more trained workers in the skilled machining trades. They did so at a rate of growth in enrollment that equals or exceeds that of most other groups of vocational education programs and program fields.*

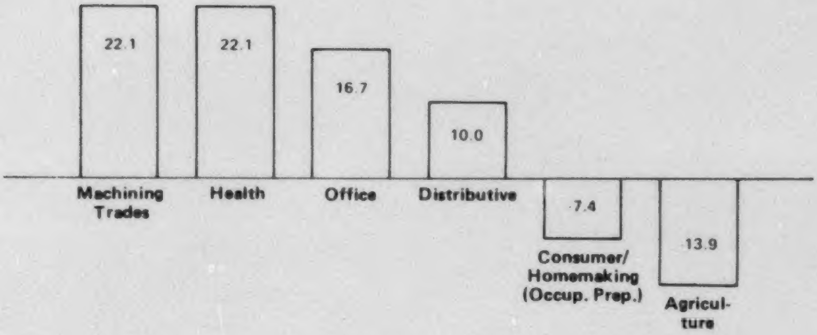

Figure 15-4. Comparative rates of growth for 1974-1975 — 1977-1978 in vocational education programs/fields

Figures 15-5 through 15-8 reflect rates of growth in postsecondary enrollments for school years 1974-75 through 1978-79 (data set 2). An examination of figures 15-5 through 15-8 reveals that the rate of growth for the three skilled machining trades-related programs exceeded the rates of growth for all nine groups of programs and fields with which it was compared. Thus, these enrollment data findings are consistent with the findings for data set 1 (figures 15-1 through 15-4).

Other interesting statistics were derived from an examination of enrollment data for machine shop, machine tool operations, and tool and die making programs. The postsecondary enrollment count in these three programs for the period 1974-75 through 1978-79 was 350,854 persons, or an average of 70,171 persons per year. The largest postsecondary enrollment in these three programs was in school year 1978-79 when enrollment reached 77,055.

What is interesting about these statistics is that enrollments in the three programs in the 1970s were at least three times larger than the projected growth of employment in the skilled machining trades.* As Rosenthal (1982) points out:

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*If secondary students are included, the average number of completions in the three programs was 31,276 for school years 1974-75 through 1977-78; and completions increased by 43 percent during this period of time.

> In the bureau's three alternative projections of employment to 1990, the average annual growth of employment for skilled machining workers (including numerically controlled machine tool operators and machine tool operators, combo) ranged from 11,900 to 23,200 from 1980 to 1990. (pp.35-36)

One should not construe this to mean that three times as many persons are being prepared as are needed. After all, only a fraction of the students enrolled end up as program completers; a lesser number seek and find employment in the field for which trained; and an even lesser number remain in these occupations, achieve journeyperson status, or go on to obtain more specialized skills for which employers seem to be in the greatest need.

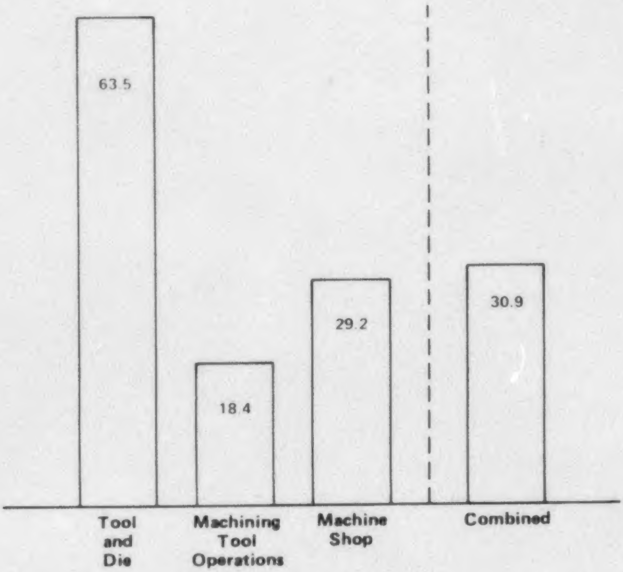

Figure 15-5. Comparative rates of growth for 1974-1975 — 1978-1979 in machining trades-related programs

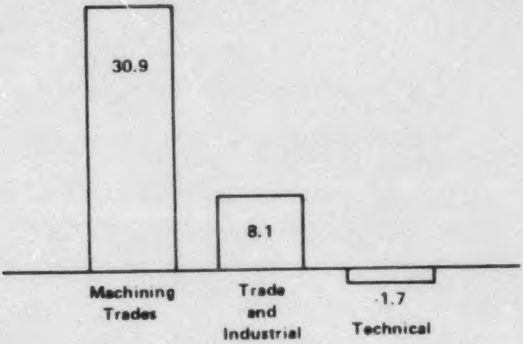

Figure 15-6. Comparative rates of growth for 1974-1975 — 1978-1979 in industrially oriented programs

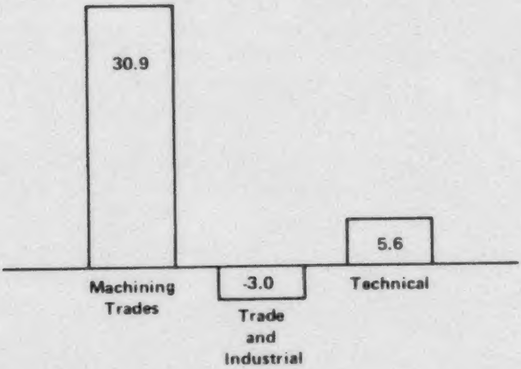

Figure 15-7. Comparative rates of growth for 1974-1975 — 1978-1978 in nonindustrially oriented programs

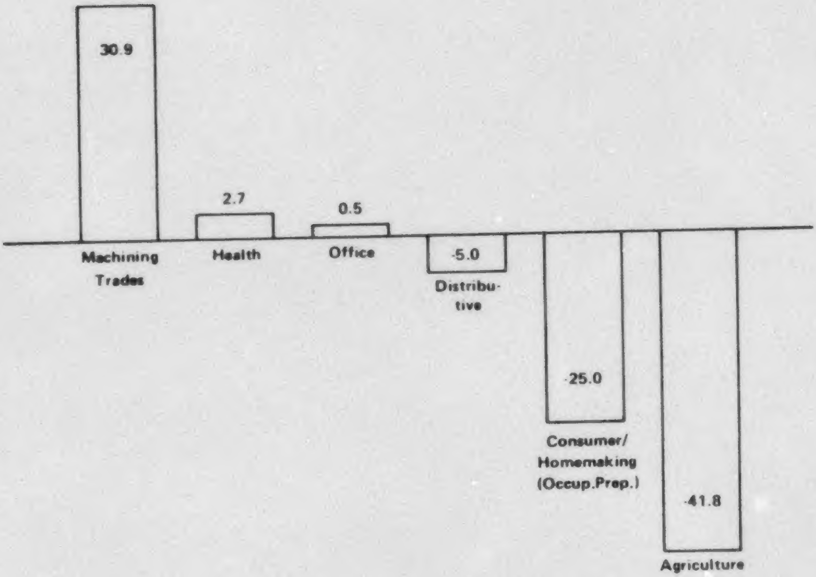

Figure 15-8. Comparative rates of growth for 1974-1975 — 1978-1979 in vocational education programs/fields

Potential Responsiveness to Other Skilled Labor Shortages

If the literature is correct and other skilled industrial occupations have also experienced shortages of workers since the mid-1970s, how has vocational education responded to this condition? To answer this question, eight kinds of occupational training programs were selected for analysis: those to train electrical technicians, electronic technicians, industrial engineering technicians, mechanical engineering technicians, carpenters, electricians, welders, and drafters. One reason for selecting these particular programs is that there is a reasonably close correspondance between occupational titles listed in the U.S. Bureau of Labor Statistics' 1978 to 1990 estimates of employment in the technical and craft occupations (Carey 1981), and these vocational education instructional program titles. The Bureau of Labor Statistics combines electrical and electronic technicians to create one occupational title and does the same for industrial and mechanical engineering technicians.

Comparisons between training program enrollments and estimates of employment opportunities in these occupations are reported in table 15-3.

The data reported in table 15-3 indicate that if postsecondary enrollments and secondary and postsecondary completions remain essentially stable for the period 1978-1990, as they did for the school years 1974-75 through 1978-79, then—

- both enrollments and completions will be greater than the number of jobs created by growth in employment for electrical/electronic technicians, carpenters, welder/flamecutters, and drafters;
- enrollments will be greater than the number of jobs created by growth in employment for electricians; and there will be only slightly fewer program completions than the number of job openings due to growth in employment for electricians; and
- enrollments will exceed the number of jobs created by growth in employment for industrial and mechanical engineering technicians; and completions from vocational education programs will represent about 60 percent of the job openings created by occupational growth.

If the enrollments in the eight vocational programs continue *at the same rates of growth* for the period 1978-1990 as they did for the school years 1974-75 through 1978-79, then it is reasonable to expect that local level vocational education might even be overresponding (in terms of training capacity and potential number of persons available for employment) to the occupational projections developed for the 1978-1990 time frame.

To depend, however, on only vocational education enrollment and completion data for estimating the supply of skilled workers in particular occupations would be inadvisable for vocational education planners. After all, a significant proportion of this country's skilled craftsworkers "pick up" their trade through informal means (Hills 1982). Other sources of supply are those workers who have received their training through such establishments as the the military, employee training programs, private schools, and correspondence schools. If one considers these other sources of supply, then perhaps vocational education is doing at least its share in responding to

TABLE 15-3
ENROLLMENTS AND COMPLETIONS COMPARED WITH AVERAGE ANNUAL EMPLOYMENT GROWTH

Occupations	Average Annual Postsecondary Enrollment (1974-75--1978-79)	Average Annual Completions (including Secondary)	Average Annual Growth 1978-1990[1]
Electrical/Electronic Technicians	50,262	17,692	16,083
Industrial/Mechanical Engineering Technicians[2]	12,283	1,745	2,917
Carpenters	63,894	40,881	24,583
Electricians	73,867	16,652	17,500
Plumbers/Pipefitters	33,755	7,638	12,583
Welders/Flamecutters	129,890	42,146	17,833
Drafters	54,369	32,387	12,750

[1] Calculated from data reported for High Trend I (Carey 1981, table 2).

[2] Includes chemical, civil, electromechanical, environmental control, industrial, instrumentation, mechanical, and metallurgical technician programs.

shortages of skilled machining trades workers. In any event, the fact that multiple sources of supply typically exist makes it imperative that vocational education planners be very cautious in interpreting published and unpublished information about shortages of skilled labor, since the available supply is not always obvious.

This situation is exemplified in the case of computer programmers, an occupation sometimes thought to be experiencing critical national shortages of trained workers. A recent article in *Business Week* ("Jobs for Programmers" 1982) points out that new jobs for entry-level programmers are beginning to disappear because major sources of supply (i.e., vocational schools, colleges, and universities) are turning out more than twice the estimated demand for entry-level computer programmers. The article does not discuss the supply of entry-level computer programmers from other major sources (e.g., those who are self-taught, or military trained).

NEW DIRECTIONS IN RESPONDING

Since the mid-1970s, there has been a rapid escalation in efforts by most state vocational education agencies to collaborate with local training providers in implementing programs tailored to the training needs of specific firms and military bases. Some of this customized training prepares persons for semiskilled employment, while other training efforts have been directed to preparing or upgrading skilled workers (Bottoms 1982; Brant 1982; Burdette 1982; U.S. Departments of Defense and Education and AVA 1982; *VocEd* 1982). However, the relative emphasis these efforts give to skilled occupational training is not clear.

In the future, state vocational education agencies might want to consider explicitly what should be an appropriate balance between allocating resources for short-term customized training for specific clients, and the longer and more expensive training of skilled workers to meet projected skill shortages.

POLICY IMPLICATIONS

The purpose of this study was to obtain insights into the past responsiveness of the public vocational education system in training industrially oriented skilled craftsworkers and technicians, so that suggestions for even greater responsiveness might be formulated. In conducting this study, it was assumed that the nation will undergo economic recovery and reindustrialization in the 1980s and beyond; that it will most likely experience a growth in defense expenditures; and that these events may be accompanied by marked changes in production technologies, many of which are difficult to forecast with certainty. If these assumptions hold true, the problem of preparing and upgrading industrially oriented skilled craftsworkers and technicians will be a critical one for the country. The findings and assumptions here suggest that state vocational education agencies may profit by examining their present planning emphases on program improvement and program approval, and by considering the desirability of addressing *planning for change* in accord with the training needs of the 1980s and beyond.

Findings

The major findings of the study can be summarized as follows:

- There is insufficient data to be certain that there will be shortages of skilled industrial workers in the 1980s and beyond. There are logical reasons for supposing that such shortages are likely.
- Information systems are not yet in place that can adequately estimate labor shortages, their extent, or locations.
- Local providers of vocational education have a record of responding to occupational skill shortages that are known to exist or are likely to exist in their service areas.
- There are many examples of short-term customized training programs for industrial craftsworkers and technicians that have been initiated and/or supported by state vocational education agencies. However, few of these agencies have given a visible priority to long term planning and policy formulation to deal with skilled labor shortages.

Implications of the Findings

These findings serve as a basis for suggesting that Congress should consider—

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- providing a framework for state and local vocational education and business and industry groups to create and sustain *job training partnership arrangements* that will actively involve employers in vocational education planning to meet skilled labor shortages. Local and state advisory councils for vocational education are not a substitute for job training partnership arrangements.

- encouraging and adequately funding the development of information systems that can forecast (even if imprecisely) occupational skill shortages and surpluses at state, regional, and national levels. The Bureau of Labor Statistics, the National Occupational Information Coordinating Committee and its state counterparts, and state and local vocational education agencies should be involved in achieving this aim.

State boards and agencies for vocational education should consider—

- formulating the kinds of long-range planning and funding policies that do not shortchange the long-term, expensive training that is required to produce skilled industrial workers who will be adaptable to the occupational skills required in the next decade. There are, for example, conflicts in many states over allocating available funds for supporting secondary and postsecondary vocational education. Given the length of time needed to educate adequately as well as train persons to be craftsworkers or technicians, more attention should be directed to how best to *articulate* secondary and postsecondary vocational education and not how to divide up available funds between the two deliverers;

- including data on demographic trends, forecasts of industrial expansion, and analyses of emerging technologies in industrial production in doing program planning to deal with skilled labor shortages.

An Additional Policy Implication

Literature reviewed in the course of the study suggests that the long-standing emphasis in federal legislation on using vocational education to enhance economic opportunities of less academically advantaged groups might conflict with vocational education's need to train persons for skilled occupations requiring high levels of computational and communications skills (National Tooling and Machining Association 1982; Ruff et al. 1981). This philosophical and economic issue has political implications as well, especially in larger urban areas. As a result of declining educational budgets, any expansion of programming that calls for high levels of competence in mathematic and reading skills may be accompanied by a reduction in programming for the less academically advantaged.

Such an occurrence may create a polarization among groups that support vocational education. In these circumstances shifts in programming, especially at the secondary level, are likely to be approached cautiously. On the other hand, this potential conflict may focus greater attention on the need to ensure that all students receive adequate basic skills instruction, and on the need to establish better articulation between general and vocational education.

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STEPHEN J. FRANCHAK

16

Factors Influencing Vocational Education Program Decisions

OVERVIEW

The purpose of the exploratory inquiry reported here is to provide policymakers and decision makers at state and local secondary and postsecondary agencies with information about what factors influence vocational administrators' decisions to add, terminate, or modify vocational education programs. Implementing program decisions is often complicated by a lack of understanding of the data or their availability and by inadequate knowledge about how the decisions were made. The study reported here has identified the factors that influence program decisions through a telephone survey of 115 secondary and postsecondary administrators.

This chapter presents the implications of the study findings for improving the ways decisions and policies are made for program offerings. It also highlights some suggestions for improving the dissemination and utilization of data for vocational education program planning and decision making.

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INTRODUCTION

The issue of how vocational education is meeting the needs of the labor market as well as the individual needs of students is a major concern for those involved in vocational education program planning and decision making. Vocational education encompasses a large and complex set of educational institutions that provide training for millions of young people and adults who intend to use the education, training, and skills acquired in these institutions for entry or progession in the labor market. These institutions have a relatively fixed investment in equipment, structures, and teachers, which are not easy to change quickly.

It was estimated (National Center for Education Statistics 1982) for the school year 1979-80 that the direct instructional costs for vocational education, including nonfederal and federal funds, amounted to approximately $5 billion, with approximately $4.6 billion coming from nonfederal sources. For the school year 1979-80, enrollments in vocational education (both occupationally specific and other) by the ten service area classifications (agriculture, marketing and distribution,

TABLE 16-1

ENROLLMENT IN VOCATIONAL EDUCATION PROGRAMS (VEA) BY SERVICE AREA: 1979-80

Service Area	Total	Secondary	Postsecondary
Agriculture	878,529	657,247	221,282
Marketing and Distribution	961,018	396,313	564,705
Health Occupations	834,296	128,672	705,624
Consumer and Homemaking	3,385,736	2,622,561	763,175
Occupational Home Economics	551,862	361,773	190,089
Office Occupations	3,400,057	1,972,161	1,427,896
Technical	499,305	32,150	467,155
Trade and Industrial Occupations	3,215,987	1,416,230	1,799,757
Industrial Arts	1,536,667	1,517,424	19,243
Other NEC	1,189,541	977,627	211,922
Total	16,453,006	10,082,158	6,370,848

SOURCE: Preliminary data from the National Center for Education Statistics, Vocational Education Data System (VEDS) 4 May 1982.

health occupations, consumer and homemaking, occupational home economics, industrial arts, office occupations, technical, trade and industrial, and other not elsewhere classified) approximated 16.5 million vocational education students (see table 16-1). In the occupationally specific programs (agriculture, marketing and distribution, health occupations, occupational home economics, office occupations, technical, trade and industry, and other not elsewhere classified), for school year 1979-80, an estimated 6 million students were enrolled. Table 16-2 gives a detailed presentation of enrollment data in occupationally specific instructional programs, by service area and by race/ethnicity, nonresident alien designation, and sex.

The importance of defining the diversity of vocational education within an institutional setting cannot be overstated. For example, Campbell et al. (1981) identified five patterns of participation by youth in secondary vocational education. This identification was based on an analysis of high school transcripts from the National Longitudinal Survey of Labor Market Experience, 1979 of youth enrolled in secondary education. The five patterns ranged from extensive involvement and commitment to vocational education to incidental use of available courses without establishing a specialty. These patterns were as follows: Concentrators (14 percent) were those students who took a substantial number of courses in a specialty area; Limited concentrators (23 percent) were similar to the concentrators except that they tended to take somewhat fewer credits; Concentrator/Explorers (13 percent) were students who tended to concentrate early in a specialty but frequently ended concentration after tenth grade; Explorers (2 percent) were students who sampled widely across program areas but did not develop a specialty; and Incidental/Personal (48 percent) were students who used vocational education to accumulate a small number of credits that were insufficient to be considered saleable skills (p.x.).

Based on the identification of these patterns of participation, Campbell et al. (1981) recommended that policymakers consider very carefully the diversity of the vocational education experience as they make decisions about the delivery of vocational education services, particularly since approximately 50 percent of the high school graduates who used vocational education offered in their schools did not do so in a manner that was directed toward securing specific employment.

TABLE 16-2

ENROLLMENT (VEA) IN OCCUPATIONALLY SPECIFIC INSTRUCTIONAL PROGRAMS, BY RACE/ETHNICITY AND NONRESIDENT ALIEN DESIGNATION AND SEX, AND BY INSTRUCTIONAL PROGRAM AREA: 1979-1980

		AMERICAN INDIAN/ ALASKAN NATIVE		ASIAN OR PACIFIC ISLANDER		BLACK NOT HISPANIC		HISPANIC		WHITE NOT HISPANIC		NON-RESIDENT ALIEN		STATUS UNKNOWN
PROGRAM AREA	Total	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Agriculture	384,940	2,842	841	2,081	750	19,710	4,602	8,548	2,771	241,642	68,038	208	21	32,886
Distribution	601,275	2,081	2,001	6,164	6,406	31,985	39,848	15,897	19,008	198,812	248,279	841	1,878	28,075
Health Occup	455,129	1,130	3,351	1,392	5,452	8,220	48,786	4,487	17,208	49,246	295,692	243	656	19,266
Home Ec Total	242,087	652	1,594	955	2,610	12,352	44,557	3,068	12,973	27,973	126,827	12	85	8,665
Office Occup	1,970,518	1,685	11,565	16,602	37,883	79,234	224,070	33,746	105,205	35[illegible],508	1,055,290	1,349	1,431	43,950
Technical	378,117	3,126	684	8,928	2,230	29,659	11,052	15,864	4,208	22[illegible],895	54,646	1,771	260	24,794
Trade & Ind Occup	1,792,052	14,574	3,169	28,392	6,962	188,304	49,620	96,038	22,707	1,06[illegible],187	230,480	1,524	376	81,719
Other Nec	146,390	535	639	384	465	12,392	19,280	2,281	6,832	4[illegible],917	57,498	11	16	1,143
TOTAL	5,979,508	30,626	23,641	64,898	62,758	381,856	441,815	179,929	190,676	2,21[illegible],180	2,136,750	5,969	4,723	240,498

SOURCE: Preliminary data from the National Center for Education Statistics, Vocational Education Data System (VEDS), 4 May 1982.

Currently, we find that vocational education is delivered primarily within institutional settings. There are approximately 7,500 institutions in the nation offering six or more vocational courses each: 4,875 comprehensive high schools, 225 vocational schools, 1,248 area vocational schools, 162 technical institutions, and 720 community and junior colleges (National Center for Education Statistics 1982).

Vocational education has experienced growing enrollments. Attention to various racial and ethnic groups and equity concerns have been mandated in the enacted legislation and by various interest groups. The result has been a demand for more systematic planning and program decision making based on rational judgments using objective data and information.

Vocational educators have faced continuing demands for an effective planning and evaluation system for making objective and cost-effective decisions about instructional programs. A review of documents on planning since 1963 attests to this attention given to effective program planning. A number of studies, such as a U.S. General Accounting Office report (1974), the National Institute of Education's *Vocational Education Study* (1981), Starr et al. (1981), Drewes and Katz (1975), and Lawrence and Dane (1974), found that federally inspired state planning and evaluation had little influence on local program decisions. Reasons cited in these various reports included limited federal dollar investment, poor data and information, and lack of resources to support effective planning and evaluation.

The evaluation requirements of the 1976 Education Amendments (Sections 105, 112, 161, 162, and 523) were directed, in part, toward improving the responsiveness of vocational education to the changing needs of industry and society. However, discrepancies exist between those demands for evaluation data and those for the requisite resources in the states and other agencies (Datta 1979). An examination of states' responses to the 1976 vocational education requirements in the spring of 1978 and the 1979-80 school year revealed that those requirements stimulated much activity (Smith et al. 1979; Beuke et al 1980; and Starr et al. 1981). However, several studies (Boruch and Cordray 1980; Hendrickson 1981; Starr et al. 1981; and Lee 1979) indicate that in program improvement, despite high levels of technical sophistication and exhortation, many planners and decision makers do not use evaluation data.

Datta (1979) indicates that little evidence exists that programs are dropped because of unfavorable evaluations. She adds that, if anything, evaluators have lamented that demonstrably ineffective programs "march on political feet undeterred by evidence" (p. 33).

Vocational administrators, planners, and evaluators have addressed continually the issue of how vocational education is meeting the needs of the labor market as well as the needs of the individual student. This issue dates back to the passage of the first vocational education act in 1917, and it continues to be a major issue in the currently operating legislation, the Education Amendments of 1976.

The role of vocational education and the practice of evaluation and planning by vocational educators provide a basis for identifying the factors that influence decisions by vocational administrators. The role of vocational education and the evaluation and planning processes that support the development of a contextual base for program decision making have an important effect on how administrators decide to add, terminate, or modify vocational education programs. In addition, the existence or lack of a defined decision-making process affects what factors are used in program decision making.

Decision making by vocational education administrators has become more complex because of the changes in the environment in which the vocational education system operates. The social, economic, technological, political, and legislative conditions that affect the information base have caused administrators to consider a variety of factors when making program decisions. Mackinnon and Wearing (1980, p. 285) reviewed various planning documents and concluded that a complex decision environment surrounds all members of society, from the private individual to corporate and governmental organizations, and that this complexity is increasing. In describing how vocational administrators must operate in a political environment, Pucel and Schneck (1980, p. 45) state that administrators serve both as a source of decision-making information (for those to whom they are responsible) and as decision makers (for those who are responsible to them). This is an important factor to consider when trying to determine what types of information will be relevant for various decision-making tasks. Copa (1980, p. 52) states that administrators seem to rely heavily on verbal sources rather than on written reports for decision-making information. This may be because verbal sources are more timely and rich in detail.

Legislative mandates have, for the most part, put decision making in the realm of a rational process to be undertaken by individuals who have clearly defined goals in regard to vocational education, with alternative decisions to be based on objective data. To bring about this objectivity, management information systems and a variety of decision-making procedures, such as PERT (Program Evaluation Review Technique), economic and occupational forecasting, Delphi, and so forth, were encouraged at the state and local levels as a result of the passage of the Vocational Education Act of 1963 and its subsequent amendments. However, decision makers have their own styles that are often different from the rational or scientific methods implied in the legislative mandates.

Various studies, such as a U.S. General Accounting Office report (1974), Drewes and Katz (1975), and Starr et al. (1981), have concluded that vocational program decision making is a complex process that is *not* clearly defined at the state and local levels. The process is not data-based according to the rational model defined in legislative mandates. Rather, management information systems and other decision-making support techniques implied in the legislation are only supplemental or fragmentary sources of information and they supply only a part of the data needed for making an administrative program decision. Pucel and Schneck (1980, p. 46) state that decisions are made in a political environment involving various groups and individuals who may have not only different but also, at times, competing interests; that the best planned data-oriented planning system cannot anticipate all of the information needed; and that, at times, decisions may be political, aimed at defending the organization or at buying time.

Effective decision making for adding, terminating, or modifying vocational education programs requires that vocational administrators be knowledgeable about the context within which their institutions function. The context includes the educational, social or community, and labor market settings. Administrators also need to understand the present and future trends affecting social and economic conditions, and related group and individual needs. A clearly defined role must be identified for vocational education and its relationships among local, state, and federal constituencies. Finally, there is a need to plan and evaluate vocational education within a framework that supports a defined decision-making process. That process requires communications linkages among administrators, teachers, evaluators, planners, employers, and special interest groups. The actual factors used in decision making come from many sources and are filtered by the decision makers in their perception of the role(s) of vocational education. The understanding of the data, their availability, and their relationship to the decision-making process in a local education institution is important. As stated in one local administrative program planning document:

> Every school district must correspondingly look at its decision-making structure, reexamine its need for information upon which decisions are made, and sufficiently modify its decision-making process so that vocational program offerings are justified in terms of employment demand data, program costs, placement statistics, and school, community, and student needs. (Portland Public Schools 1977, p. iii)

Overview of Study Design

This paper is based on data and information collected from 115 nonstructured telephone discussions. Fifty-five occupational administrators from secondary vocational insitutions and sixty occupational administrators from postsecondary occupational institutions comprised the sample.

A nonprobability sampling design was used for the purpose of this study. Sampling frames for drawing the sample were chosen from selected National Center mailing lists and national directories. These lists of public secondary and postsecondary institutions included the following:

- National Association of Large City Directors of Vocational Education for Cities over 100,000
- National Association of Large City Directors of Vocational Education for Largest Cities in State
- Patterson's American Education Directory (1981 edition)
- National Alliance of Postsecondary Institutions
- American Association for Community and Junior Colleges Directory of Postsecondary Institutions (1981 edition)

Judgment sampling was used in selecting sites. Such factors as rural and urban areas and type of vocational school were used for this selection. Geographic representation was also considered. The intent was to have as many states as possible represented within the constraints of the budget and scope of the study. The telephone discussions included twenty-nine states in the secondary sample and thirty states in the postsecondary sample. Fifty-five percent of the sites in the postsecondary sample were classified as urban areas and 45 percent of the sites were classified as rural. In the secondary sample, 74 percent of the sites were classified as urban and 26 percent as rural. The designation of rural or urban was based on the 1980 U.S. Census of Population of cities and counties conducted by the U.S. Bureau of Census. No attempt should be made to generalize findings from this exploratory study to vocational education institutions across the United States.

Reliability and Validity Concerns

The data-gathering techniques used in this study followed Guba and Lincoln's (1981, p. 106) suggestions that emphasize careful coding and recoding of data and information and a continual scrutiny of data for internal consistency, as well as cross-checking of inferences with selected interview material and continual assessment of subject credibility.

To address concerns of validity, the different data sources were cross-checked, and interviewer perceptions were tested against those of participants (House 1981). Further, the technique of triangulation was used to address the credibility of the data and information collected. The data sources used in the triangulation process were *Conditions Affecting Vocational Education Planning* (Starr 1981) and *Factors Influencing the Job Placement of Former Secondary and Postsecondary Students* (McKinney et al. 1981, 1982).

Data Collection

A common format was used for all telephone conversations and face-to-face discussions with vocational administrators. The interviewers used the open-ended format based on the elite interviewing techniques defined by Dexter (1970). Within this framework, project staff set the context for discussions by stating: "Current trends on

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vocational education and the economic and demographic conditions cause one to do some serious thinking about vocational education program decision making. Many believe that decisions affecting the addition, termination, or modification of vocational programs are critical to the overall quality of vocational education. What are your thoughts relating to factors influencing decisions to add, terminate, or modify programs at your school?"

Four persons conducted the telephone interviews. The interviewers had previous training and experience in conducting interviews relating to vocational education and in studying administrative decision making. A common interview format was followed by all interviewers. Length of the interviews ranged from fifteen minutes to fifty-five minutes, with the average interview length being twenty-five minutes.

For each interview, notes were taken and descriptive reports were prepared. A content analysis was made of the descriptive reports. The results of the content analysis were used to generate a listing of the factors that vocational administrators identified as influencing their decisions to add, terminate, or modify vocational education programs. Descriptive statistics were used for the purpose of the analysis.

Findings and Discussion

The major findings from this study are presented by organizing the information according to secondary and postsecondary respondent groups and the key decision points for adding, terminating, and modifying vocational education programs. The data and information represent the respondents' perceptions of factors they believed influenced their decisions to add, terminate, or modify vocational education programs. Several factors were often cited for program decisions, so one cannot conclude that one factor was the sole source of influence.

Secondary Respondent Results

Fifty-five respondents representing twenty-nine states participated in the telephone discussions. The respondents held the position of vocational director of their respective school districts.

In all cases, the respondents indicated that more than one factor was used in the decision-making process and that this process was multidimensional with respect to the number of factors and persons involved. Table 16-3 presents a summary of those factors considered influential in decisions to add, terminate, or modify vocational education programs at the secondary level.

Adding programs. Existing economic conditions and demographic conditions relating to declining enrollments were often cited as reasons for not considering the addition of programs. Consideration to add programs when identified was associated with the building of a new vocational school or vocational center in a school district.

The most frequently mentioned factor in considering the addition of a vocational education program was information from advisory committees. Seventy-eight percent (n=43) of the respondents identified this factor as important in making a decision to add a program. The information that administrators generally sought from the advisory committees was the identification of a program to satisfy local employer job needs. In some instances, the respondents indicated that advisory committees were used as a validation source for job needs originally identified through published data. The majority of the respondents indicated that they were more inclined to believe the information provided by the advisory committees than that found in published data sources. One administrator appeared to capture the feelings of the majority of the respondents in regard to advisory committees' use and effectiveness:

> Advisory committee benefits are proportional to involvement in the program. If we have only two meetings a year to satisfy federal requirements, we have nothing. But if we use them with a clearly defined goal in mind, most are effective. Effectiveness is determined by the administrator involvement and teacher involvement.

The second factor considered important was industry surveys initiated or conducted by the school district. Sixty-nine percent (n=38) of the respondents indicated that locally conducted surveys by school personnel or those contracted out to consulting firms or agencies such as the local chamber of commerce were influential in decisions to add vocational programs. Both formal and informal survey techniques were identified by respondent groups. In comparing the usefulness of the local industry survey information with that of state or national

TABLE 16-3

FACTORS INFLUENCING PROGRAM DECISIONS BY NUMBER AND PERCENT OF SECONDARY VOCATIONAL ADMINISTRATORS

(Based on Telephone Discussions)

ADDING	No.	%	TERMINATING	No.	%	MODIFYING	No.	%
Advisory Committee Input	43	78	Student Enrollment Figures	24	44	Advisory Committee Input	44	80
Industry Surveys	38	69	Student Interest	20	36	Faculty & Administration Input	15	27
Student Interest	26	47	Job Placement Rates	19	34	Industry Surveys	13	24
State Labor Market Data	21	38	Needs Assessments	14	25	Community Surveys	7	13
Program Cost	16	29	Lack of Qualified Faculty	11	20	Student Interest	6	11
Community Surveys	14	25	Program Cost	9	16	Occupational Data	5	09
Student Enrollment Figures	11	20	Advisory Committee Input	9	16	Industrial Visits	5	09
Faculty & Administration Input	9	16	Industry Surveys	7	12	Employer Follow-up Data	4	07
Job Placement Rates	8	14	Community Surveys	6	11	Program Evaluation	4	07
Occupational Data	5	09	Student Follow-up Data	5	09	Job Placement Rates	4	07
Employer Follow-up Data	5	09	Faculty & Administration Input	4	07	State Labor Market Data	4	07
Student Follow-up Data	2	04	State Labor Market Data	4	07	Literature Reviews	3	05
Political Implications	1	02	Occupational Data	2	04	Student Enrollment Figures	2	04
			Obsolete Equipment	1	02	State Requirements	2	04
			Literature Reviews	1	02	Competency-based Instruction	1	02
						Articulation with Post-secondary Programs	1	02

NOTE: Multiple responses were given by all respondents in identifying factors for influencing their program decisions. n=55.

published data sources, the majority of the respondents supported the survey information over the published sources.

A third factor, student interest, was identified by 47 percent (n=26) of the respondents. Meeting the needs of students was considered to be a major factor. Some administrators indicated that student interest has long supported such programs as auto mechanics and cosmetology, despite poor placement records of those programs. However, they indicated that continuing economic conditions resulting in smaller budgets will cause administrators to reassess the high weighting of student interest. Such factors as job placement rates and program costs were identified as candidates for higher consideration in decisions to add programs.

State labor market information was cited by 38 percent (n=21) of the respondents. Of this group of respondents, seven individuals indicated that information from the state employment service was used. The majority of the respondents indicated that the published data provided by state and national sources were not specific to their needs and were considered only because of requirements for state or national planning activities. Levitan (1978, p. 2) seems to define the usage when he comments on the use of unemployment statistics: "To paraphrase an old advertisement: We're using the statistics more now but believing them less."

Administrators from three rural schools captured the feelings of the majority of the respondents interviewed by stating that state and national published data were used very little. One administrator stated, "If we relied on published data, we would shut our program down, and these are programs which are placing individuals in jobs." The administrator added, "The published labor market information does not meet our needs; trends are not accurate for this county." In addressing the lack of utilization of state and local occupational projections, the National Commission on Employment and Unemployment Statistics (1979, pp. 109-110) concluded that information supplied to state vocational education authorities was largely unused because:

> [In part,] vocational education officials were accustomed to depending on industry contacts or advisory groups for job prospect information; in part because of rigidities imposed by existence of tenured teachers of various specialties or expensive equipment for teaching specific skills; in part because of vocational educators' unfamiliarity with occupational statistics, or distrust of outside agencies.

The findings from the current study lend support to the National Commission's conclusion, particularly in regard to continued reliance on industry contacts or advisory groups as a more important source of information on job prospects than state-published labor market information.

Program cost was identified by 29 percent (n=16) of the respondents. Continuing reference to program costs as one factor that is growing in importance was made by the respondents. Citing current and projected economic conditions, administrators indicated that a reordering of factors would probably occur because of increased operating expenditures.

Other factors that the administrators said they considered in adding vocational programs were: community surveys, 25 percent (n=14); student enrollment figures, 20 percent (n=11); faculty and administration input, 16 percent (n=9); job placement rates, 14 percent (n=8); occupational data, 9 percent (n=5); employer follow-up data, 9 percent (n=5); student follow-up data, 4 percent (n=2); and political implications, 2 percent (n=1).

Terminating programs. Terminating a vocational program at the secondary level was not considered a common practice by those vocational administrators interviewed. However, administrators who had closed programs or said they would consider closing a program indicated the following in regard to factors that influenced or would influence their decisions to close a program.

Again referring to table 16-3, the factor cited most frequently for terminating programs was student enrollment. Forty-four percent (n=24) of the respondent group indicated that if enrollments were adequate, programs would continue to operate; and if they fell below a district-approved level, they generally would be put on probation for a certain time or be terminated. A related factor, student interest, was identified by 36 percent (n=20) of the respondents. This factor was considered to be highly correlated with student enrollment, but it was expressed as a separate element for program decision making by the majority of administrators.

The third factor, in order of importance, was job placement rate, which 34 percent (n=19) of the respondents indicated as influential in program decision making. A needs asesment was identified by 25 percent (n=14) of the respondent group as a factor to be considered in deciding whether to terminate an occupational program. This was described as a comprehensive assessment involving students, employers, teachers, and parents.

Other factors considered to possess a high degree of importance included: a lack of qualified faculty, 20 percent (n=11); cost of program, 16 percent (n=9); advice of advisory committee, 16 percent (n=9); results of industrial surveys, 12 percent (n=7); community surveys, 11 percent (n=6); student follow-up data, 9 percent (n=5); faculty and administration input, 7 percent (n=4); state labor market data, 7 percent (n=4); occupational data, 4 percent (n=2); obsolete equipment 2 percent (n=1); and information from literature reviews, 2 percent (n=1).

Modifying programs. Modifying occupational programs was considered a more common type of program decision by the respondents in this study. The single most important factor cited by the respondents to aid in the decision making was information provided by advisory committees as shown in table 16-3. Seventy-six percent (n=42) of the fifty-five respondents identified this factor. Further, craft/program advisory committees were more often mentioned as providing the information (n=30) as opposed to the general advisory committees (n=12).

Faculty and administrative input was identified by 27 percent (n=15) of the respondents. Industry surveys, conducted by lcoal schools or by other agencies, were identified by 24 percent (n=10) of the respondents. A fourth factor, community surveys, which were considered to be related to industry surveys but were focused more on the social and economic needs of the general public, was identified by 3 percent (n=7) of the respondent group.

Other factors considered to be important included: student interests, 11 percent (n=6); occupational data, such as changes in technology, salary, and working conditions, 9 percent (n=5); employer follow-up data, program evaluation, job placement rates, and state labor market data, 7 percent, (n=4); information from literature reviews, 5 percent (n=3); student enrollment figures and state requirements, 4 percent (n=2); and competency-based instruction and articulation with postsecondary programs 2 percent (n=1).

Postsecondary Respondent Results

Sixty respondents at the postsecondary level representing thirty states participated in the telephone discussions. All respondents held administrative positions, such as dean of occupational education, or president, dean, or vice president for academic affairs, with major responsibilities for program decisions relating to the occupational education programs in community colleges or two-year technical institutes.

Twenty-eight factors were identified from the sixty interviews as being considered part of the administrative decisions to add, terminate, or modify occupational education programs. The majority of the postsecondary respondents indicated, as did those at the secondary level, that a variety of factors influenced their decisions to add, terminate, or modify a vocational program. Also, as was found in the interviews with secondary school administrators, decision making was a multidimensional process that included a number of individuals and groups involved in identifying data and information. Table 16-4 presents the summary of factors considered to influence decisions to add, terminate, or modify postsecondary vocational programs.

Adding programs. The influencing factor cited most often by the postsecondary administrators was industry surveys. The majority of the respondents indicated that, generally, both formal and informal surveys were conducted by their respective institutional staff. Seventy-five percent (n=45) of the sixty respondents indicated that this factor was used in deciding to add programs. Fifty-two percent (n=31) of the respondents indicated that advisory committees were influential in deciding to add programs. Respondents were about evenly divided as to the type of advisory committees used to provide information, with fifteen respondents indicating the craft or program advisory committees and sixteen respondents indicating the general advisory committees.

The third factor was program costs, with 42 percent (n=25) of respondents indicating that costs played an important part in their program decisions. It should be noted that the majority of the administrators indicated that economic conditions and resulting budgetary problems were increasing the importance of costs.

Thirty-five percent (n=21) of the respondents indicated student interest was a factor in their deciding to add programs. State labor

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TABLE 16-4

FACTORS INFLUENCING PROGRAM DECISIONS BY NUMBER AND PERCENT OF POSTSECONDARY VOCATIONAL ADMINISTRATORS

(Based on Telephone Discussions)

ADDING	No.	%	TERMINATING	No.	%	MODIFYING	No.	%
Industry Surveys	45	75	Student Enrollment Figures	34	56	Advisory Committee Input	35	58
Advisory Committee Input	31	52	Job Placement Rates	33	55	Faculty & Administration Input	30	50
Program Cost	25	42	Industry Surveys	18	30	Industry Surveys	15	25
Student Interest	21	35	Program Costs	17	28	Program Costs	5	08
State Labor Market Information (published data)	20	33	Student Interest	13	22	Occupational Data	4	07
Faculty and Administration Input	16	27	Student Follow-up Data	13	22	Community Surveys	3	05
Community Surveys	13	22	Advisory Committee Input	11	18	Student Interest	3	05
Needs Assessments	9	15	Occupational Data	9	15	Student Follow-up Data	3	05
Occupational Data	8	13	Program Evaluation	8	13	Program Evaluation	2	03
Job Placement Rates	8	13	Faculty and Administration Input	5	08	State Labor Market Data	2	03
Student Enrollment Figures	4	07	State Labor Market Data	4	07	Competency-based Instruction	2	03
Student Follow-up Data	3	05	Number of Graduates	4	07	Job Placement Rates	1	02
Literature Reviews	3	05	Employer Follow-up Data	3	05	Student Enrollment Figures	1	02
Industrial Visits	2	05	Community Surveys	2	03	Skill Shortages	1	02
Perception of Institution Mission	2	05	Skill Shortages	2	03	Political Implications	1	02
Political Implications	2	05	Lack of Qualified Faculty	2	03	Funding Patterns	1	02
Skill Shortages	2	05	Funding Patterns	1	02			
Funding Patterns	2	05	Competency-based Instruction	1	02			
Space Availability	2	05						

NOTE: Multiple responses were given by all respondents in identifying factors for influencing their program decisions. n=60.

market data were identified by 33 percent (n=20) of the respondents for use in the decision-making process. However, a majority of the respondents indicated that the data were of questionable value for their local or regional needs and were used in compliance with or to reinforce a decision that already had been made.

Other factors considered important included: faculty and administrative input, 27 percent (n=16); community surveys, 22 percent (n=13); needs assessments, 15 percent (n=9); occupational data and job placement rates, 13 percent (n=8); student enrollment figures, 7 percent (n=4); student follow-up data and literature reviews, 5 percent (n=3); and industrial visits, perception of institutional mission, political implications, skill shortages, funding patterns, and space availability, 5 percent (n=2).

Terminating programs. The most frequently cited factor for terminating vocational education programs was low student enrollment. Fifty-six percent (n=34) of the postsecondary administrators indicated that enrollment had a primary influence in their decision to terminate a program.

Job placement rate was another factor commonly mentioned as influencing the administrator's decision to terminate a program. Fifty-five percent (n=33) of the administrators indicated that low job placement of completers over a continuing period of time, such as two years, raised questions about a program's continuance. However, the majority of the respondents indicated that the prevailing and projected economic conditions in the local area had to be taken into account before a decision to terminate a program was implemented.

Thirty percent (n=18) of the postsecondary administrators indicated that their locally conducted industry surveys were used in providing information for program termination. A total of 28 percent (n=17) of the postsecondary administrators stated that costs entered into the decision to terminate a program. As noted earlier, current and projected economic conditions were cited as becoming more prominent in decisions about vocational programs. Both student interest and student follow-up were indicated by 22 percent (n=13) of the respondents as factors that were considered in deciding to terminate a program.

Other factors having importance included: advisory committees, 18 percent (n=11); program evaluation, 13 percent (n=8); faculty administration input, 8 percent (n=5); state labor market data and number of graduates, 7 percent (n=4); employer follow-up data, 5 percent (n=3); community surveys, skill shortages, and lack of qualified faculty, 3 percent (n=2); and funding patterns and competency-based instruction, 2 percent (n=1).

Modifying programs. Modifying occupational programs was considered a primary activity in addressing program improvement. In the words of one administrator, "Program modification often solves the problem of a program which should be terminated." Approximately 75 percent of the administrators indicated that modification was often a first step before terminating or adding a program. Fifty-eight percent (n=35) of the administrators cited advisory committees as influential in their decisions to modify programs. Additionally, 50 percent (n=30) of those administrators identified faculty and administration input as instrumental in the decision-making process. Twenty-five percent (n=14) of the administrators stated that locally conducted surveys were used as input into the decision-making process.

Other factors mentioned, but with less frequency, included occupational factors, such as changing technology and job salary, 7 percent (n=4); community surveys, student follow-up and student interest, 5 percent (n=3); program evaluation, state labor market data, and competency-based instruction, 3 percent (n=2); and job placement rates, student enrollment figures, skill shortages, political implications, and funding patterns, 2 percent (n=1).

Comparison of Secondary and Postsecondary Respondents

There were a number of factors used by vocational administrators in deciding to add, terminate, or modify vocational education programs. In examining the telephone responses of both secondary and postsecondary vocational administrators, twenty-five factors were identified by the secondary administrators and twenty-eight factors were identified by the postsecondary administrators.

Figures 16-1, 16-2, and 16-3 summarize the responses by both secondary and postsecondary administrators. Table 16-5 presents a comparison of factors cited by secondary and postsecondary administrators according to a ranking based on the number of respondents citing a particular factor for each decision type.

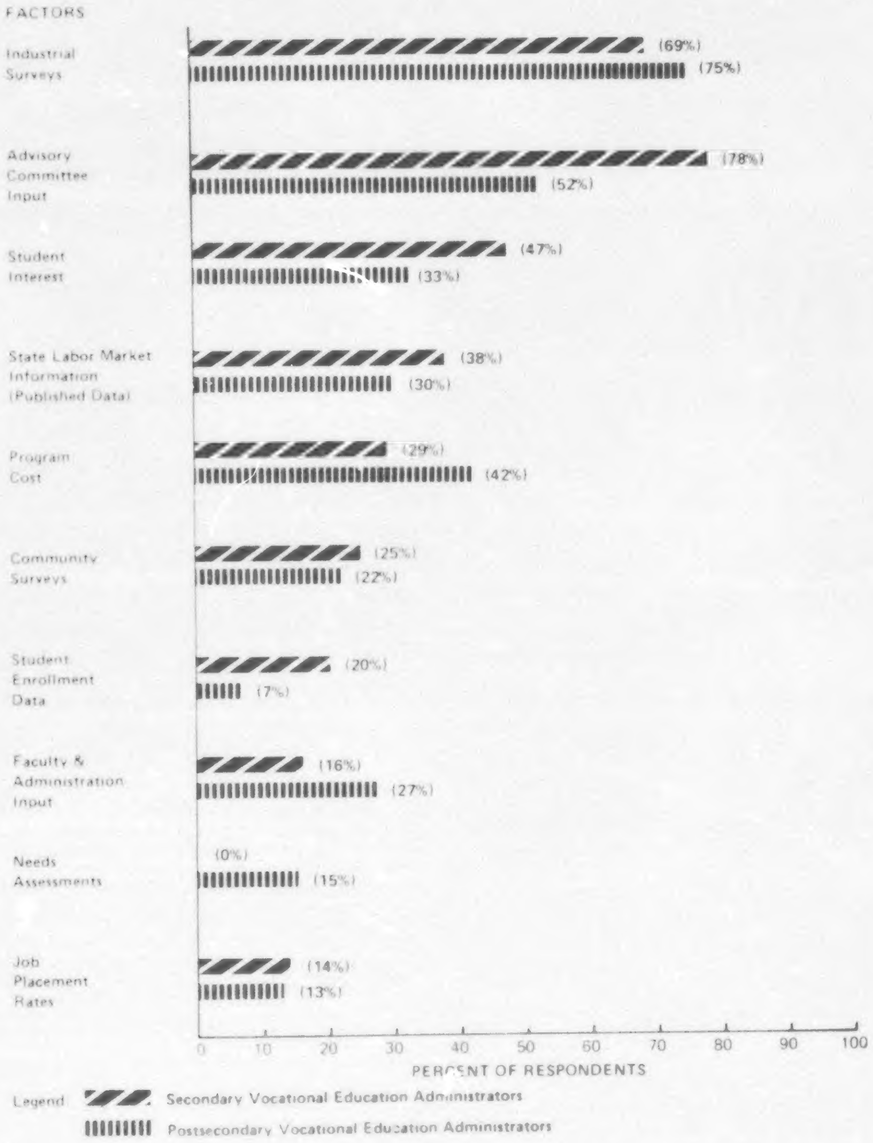

Figure 16-1. Factors influencing decisions of secondary and post-secondary vocational education administrators to add programs

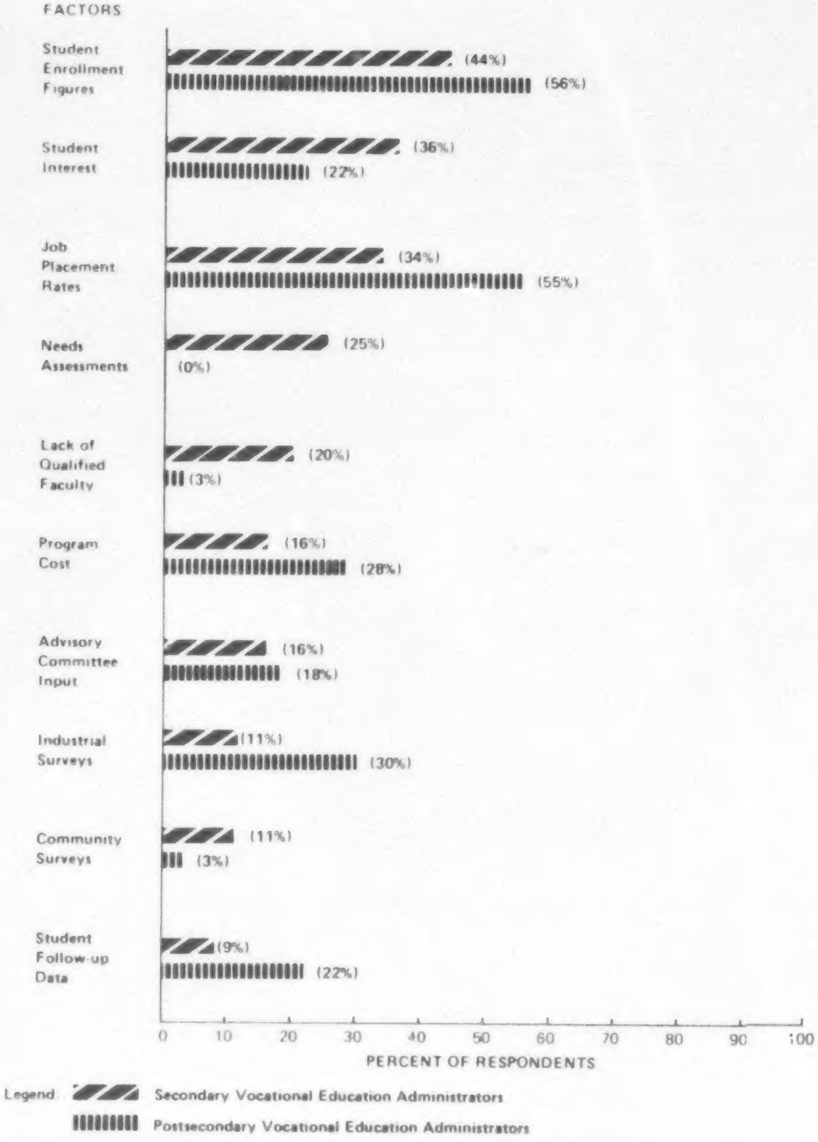

Figure 16-2. Factors influencing decisions of secondary and post-secondary vocational education administrators to terminate programs

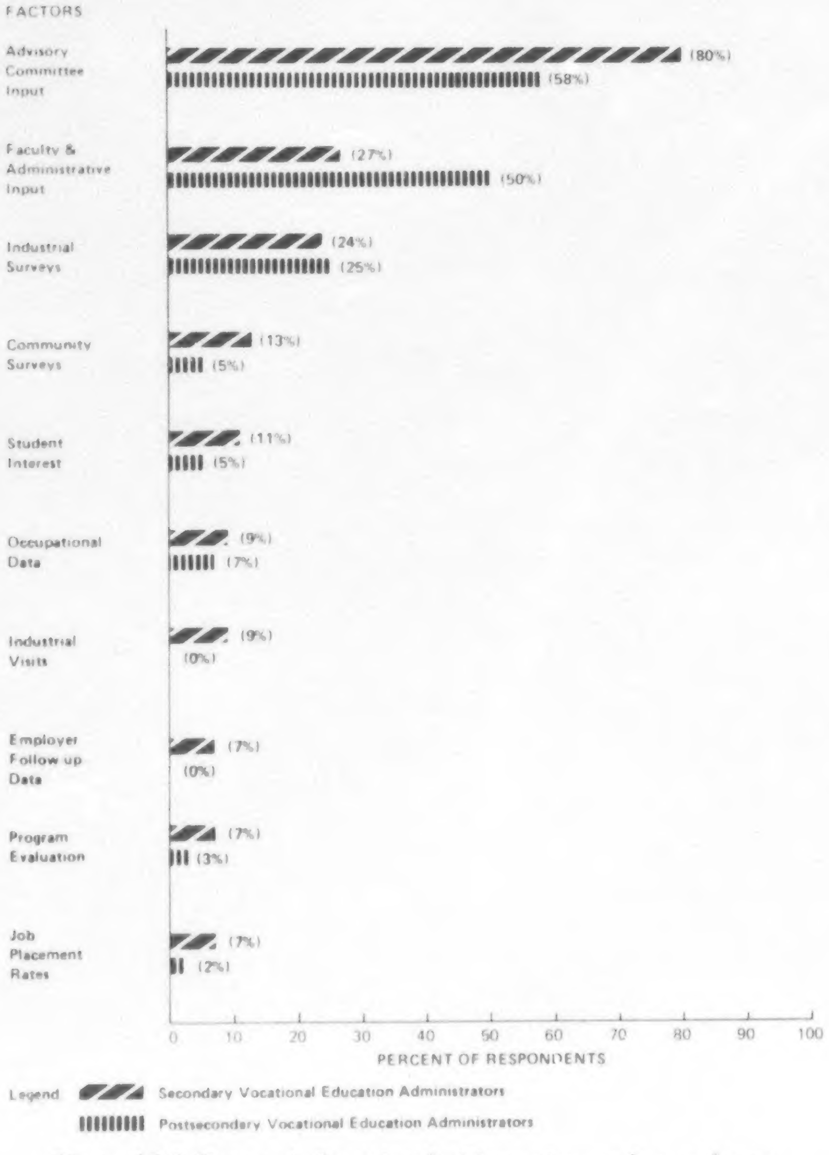

Figure 16-3. Factors influencing decisions of secondary and post-secondary vocational education administrators to modify programs

TABLE 16-5

RANK ORDER OF FACTORS INFLUENCING PROGRAM DECISIONS BY VOCATIONAL EDUCATION ADMINISTRATORS (Based on Telephone Discussions)

Factors	Decision Type					
	Adding		**Terminating**		**Modifying**	
	Sec.	Postsec.	Sec.	Postsec.	Sec.	Postsec.
Industry Surveys	2	1	8	3	3	3
Advisory Committees	1	2	6.5	7	1	1
Program Cost	5	3	6.5	4	-	4
Student Interest	3	4	2	5.5	5	7.5
Student Enrollment Figures	7	11	1	1	12.5	12.5
Job Placement Rates	9	9.5	3	2	9.5	12.5
State Published Labor Market Data	4	5	11	11	9.5	10.5
Faculty & Administrator Input	8	6	11	10	2	2
Community Surveys	6	7	9	14	4	7.5
Needs Assessments	-	8	4	-	-	-
Occupational Data	10.5	9.5	13	7	6	5
Student Follow-up Data	-	12.5	-	5	-	7.5
Literature Reviews	-	12.5	14	-	11	-
Industrial Visits	-	14.5	-	-	6.5	-
Perceptions of Institution Mission	-	14.5	-	-	-	-
Skill Shortages	-	14.5	-	15.5	-	12
Funding Patterns	-	14.5	-	17.5	-	12
Space Availability	-	14.5	-	-	-	-
Political Implications	13	14.5	-	-	-	12
Competency-based Instruction	-	-	-	17.5	14.5	9
Employer Follow-up	10.5	-	-	13	9.5	-
Lack of Qualified Faculty	-	-	5	15.5	-	-
Program Evaluation	-	-	-	9	9.5	9
Obsolete Equipment	-	-	14	-	-	-
Articulation with Secondary/Postsecondary Programs	-	-	-	-	14.5	-
State Requirements	-	-	-	-	12.5	-

NOTE: The rank order of factors was based on the frequency of response by the vocational administrators. The highest rank of one indicates that the factor was mentioned by more vocational administrators than any other factor. A "-" indicates that no mention was made of this factor as influencing the vocational administrators decision to add, terminate, or modify a program.

Summary of Findings

In summary, program decisions by secondary and postsecondary vocational administrators do not really seem to be entirely data-based, even though published data were cited and reviewed in the program decision-making process. Data, for the most part, were used to meet state or federal planning requirements or to verify a decision already made.

The use of data and information by local administrators has evolved over time and has guided legislation as well as state and federal policy requirements. There is some question whether they represent a well-defined and integrated system of data and information use. Further, a closer tie with evaluation and planning systems needs to be reflected in an administrators' program decision-making information base.

A clear definition and understanding of the role of vocational education and its function in human resource or employment and training policies at the local, state, and federal level should be developed. If this is not accomplished, we will continue to witness local program decision making that depends on many factors that do not reflect the rational decision making that the vocational legislation intends.

The results of this study show that this select group of administrators do consider the effect on their constituents by relying on advisory committee input and on community and industrial surveys, tempered by student interest and enrollment. They consider program feasibility in light of a consensus of these factors and, lastly, seem to focus on substantive information, such as published labor market information, for verification of what has already been decided.

The following listing of selected findings reflects the overall patterns of factors that affect local administrators' decisions to add, terminate, or modify vocational programs:

- Locally conducted industrial surveys had a major influence on program decisions. These surveys were conducted in both a formal and an informal manner. Administrators expressed the need for locally conducted surveys because of the lack of trust in the state and nationally published occupational data.

- Advisory committees were considered very influential in decisions to add or modify programs. However, the effective use of the committees was a concern of most administrators.

- Student enrollment figures and student interest were considered to be very important for adding or terminating a program. Administrators believed these factors could be positively affected by better counseling programs and through improved "advertising" of programs.

- Published occupational data were used most often to verify or support a program decision that had already been made. However, they were seldom used to implement ideas for program changes. Adminstrators expressed a continual concern over the accuracy of the occupational data in regard to their specific geographic area, and its relationship to their vocational education programs.

- Job placement rates were mentioned as a factor to be considered in program decisions, but few secondary administrators indicated it would be reason for a program addition or termination. However, a majority of postsecondary administrators indicated that low job placement rates were instrumental in decisions to terminate a program, if economic conditions were likely to continue to cause the low job placement to occur.

- Faculty and administration input was considered a major factor in program modification by both the secondary and postsecondary administrators. Related to this factor was the focus on industrial visits by faculty and administration for obtaining decision-making information. Although only a few cited industrial visits as a factor, a majority of the respondents indicated industrial visits were needed and should have occurred on a regular basis. However, financial, logistical, and other factors often prohibited this from taking place.

Recommendations

The following selected recommendations are based on the preliminary findings of this study on the factors influencing vocational education program decisions.

The need to build an effective use of advisory committees is one area where local administrators seem to be most in agreement. A number of efforts to provide information and training have been launched in the past by various agencies, including the American Vocational Association, the National Center for Research in Vocational Education, the National Association for Industry-Education Cooperation, and the National Institute for Work and Learning. However, these efforts need to be geared to the actual programmatic decisions that take place in local schools, with a focus on the key participants and their decision-making style.

Continued efforts are needed to disseminate labor market information and provide technical assistance in its interpretation and in the determination of its applicability for local program decision making. The growing awareness of the NOICC and SOICC efforts needs further support, and closer attention to local decision-making processes is also needed. Adminstrators indicated there was a greater need to provide time for teachers to participate in visits to various industries on a regular basis. However, budgetary and other personnel agreement factors need to be addressed to ensure implementation of such activities. This viable strategy for getting valuable information for program decision making has implications for the reauthorization of vocational education. Congress should provide incentives for schools to establish programs where this could occur on a regular basis.

A quote from a Minnesota legislator, involved in the National Science Foundation study on targeting the transfer of evaluative scientific information between research and legislators in forty-two states, seems to capture the essence of the findings, problems, and solutions regarding vocational education program decisions:

> Legislative priorities exist in the following order with regard to a particular issue: first, legislators consider the effect on constituents (how do they feel about it?); second, they consider legislative feasibility (is there a consensus to do something about it?); and only in last place, do they consider substantive information (what do we know about it?). The legislator thus reverses the priorities of the ideal "statesman-policymaker" who puts substance first and constituents last. Also, somewhere within the legislator's last priority lies the researcher's top priority. And this explains quite a few things. For example: why emotional issues (i.e., constitutent issues) dominate legislatures; why, if you come in with substance but without showing how constituents will be affected or what

legislative strategy is possible, you won't get much response, no technical ones; and why time frames for legislative action are geared to time in office, not to the amount of time needed to solve the problem. (Voss 1979)

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RONALD E. KUTSCHER

17

Vocational Education's Responsiveness: Reactor Comments

In reviewing the chapters by Stephen Franchak and Harold Starr, I feel that both authors have done a thorough job and produced discussions of interest. While the survey described by Stephen Franchak is statistically weak, he is very careful in describing it and never claims more for it than he should. I find, therefore, little to argue with in either of these chapters. Both authors conclude that vocational education is conducted for locally perceived employment needs and, to a lesser extent, for the interest of local persons. Clearly, vocational education is conducted from the perspective that it should be directed toward local needs, since in many instances local taxpayers pay for a sizable part of the training. Also, it is generally agreed that training quality is improved by the involvement of local industry because industry requires up-to-date skills and training in use of the latest equipment. Further, both authors conclude that state and national trends are often ignored in planning vocational education, but that local employment and occupational trends are frequently among key ingredients used in planning.

While I have only favorable comments for the content of the two chapters, I believe the authors have neglected some important facts and considerations in their conclusions. Although I don't necessarily object to the recommendations and conclusions they propose, I feel that they have not taken into consideration some important factors concerning vocational education.

If vocational education is structured as these authors report, and I believe they are correct in what they report, vocational education is not dealing with some important facts concerning the labor market activity of the young. Vocational education is based on the premise (at least implicitly) that an individual is trained in an occupation, takes a job with an employer, and stays long enough in that occupation and in that geographic area to return the public investment to the local area that provided most of the funding for the training.

However, data show that this premise may be incorrect. For example, between 67 and 78 percent of young people twenty-two to twenty-nine years old will change their residence in a five-year period. Of these, 30 to 40 percent will move to another county, and between 15 and 18 percent will move to another state (U.S. Department of Commerce 1981). Further, of sixteen- to nineteen-year-olds, 48 percent will leave the occupations they were in only one year earlier; of twenty- to twenty-four-olds, 32 percent will leave their occupations one year later; and of twenty-five- to thirty-four-year-olds, 19 percent will leave their occupations (U.S. Department of Labor 1982). Also, research by Robert E. Hall (1982) shows that the average worker by age seventy has had at least ten employers, with over half (or 5.5) of those being by the time the worker has reached age twenty-nine.

What emerges from these data, it seems to me, is a period between the ages of sixteen and thirty in which many young workers are devoted to a search for (1) the geographic area in which they are to live; (2) the occupation in which they wish to work; and (3) the employer for whom they wish to work. This pattern becomes clearer when compared to older age groups. As an illustration, the same sources cited previously show that (1) those who move out of the county by age forty-five are only 14 percent over a five-year period; (2) occupational mobility for forty-five- to fifty-four-year-olds drops to about 10 percent; and (3) by age forty-five, the average worker has worked for nine of his or her potential 10.5 employers. Also, over half of all workers will ultimately stay with an employer for twenty or more years.

These factors concerning the labor market activity have, it seems to me, significant implications regarding the following questions:

1. Is vocational education, particularly at the secondary level, serving the jurisdiction that pays for it or even if it is serving the individuals residing in a given geographic area, will the trainees stay in the geographic areas long enough to pay the tax funds back?

2. Should projections of local trends be used in planning vocational education programs? Is it realistic to assume that we can ever develop accurate projections for Pocatello, Peoria, and Pottstown, Pennsylvania? Remember that to develop moderately accurate projections of occupational requirements at the local level, it is necessary to project on the demand side not only long-term structural and technological shifts and the expected implications for various occupations but, in addition, plant openings, plant closings, and plant expansions by industry. On the supply side it would be necessary to project mobility, both geographic and occupational. Given the difficulties of ever developing such data, questions must be raised about the advisability of using local projections in vocational education planning. Such planning is not required for higher education. Is it required for vocational education principally because of the assumption that is is serving the local area?

3. Should local employer surveys be used in planning vocational education? Both authors mention that local employer surveys are used in the planning process. Yet, they have proven to be inaccurate sources for long-term labor market conditions and for training requirements. Franchak's discussion in particular shows they are still widely used. One of the major failures of employer surveys is their inability to capture plant closings, openings, or expansions.

4. Are placements a good measure of success of vocational education programs? Placements will be very high in an occupation with the highest occupational and/or geographic mobility. If an individual leaves an occupation in a very short time, is the investment the public has made in training returned? Further, in at least some training areas, employers see vocational education not as a training source but as a good screening device.*

This discussion argues for the focus of the projections used in vocational education planning to consider not only the local area but also a broader geographic area, such as a region or state. A related question can be raised regarding secondary vocational education and whether it shouldn't focus even more on broader offerings to help the young in the screening and search process for their life work. However, it may be possible that only actual job experience can be of assistance in this screening process used by many young workers. To what extent does vocational education aid this process and act as a screening/experience device needed by workers in the search for their life work? If it does aid in screening, patterns of student completion of vocational education may be different from the average depicted in the earlier data I described. Where vocational training at the secondary level is used as a substitute for more rigorous training in math, English, and other subjects, is the student well served in his or her search for a career?

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*See Rosenthal (1982).

Further, these data concerning labor market behavior of the young raise questions about whether postsecondary education is structured in the best way. Why not have postsecondary vocational schools specialize, with fewer vocational training facilities developed? Hopefully this, at least over the longer run, might lead to higher-quality training. This specialization could be easier to accomplish if the geographic focus of training were broader. It also would seem advisable to focus on a slightly older age group (this is probably already happening), after the search described earlier is further along.

In conclusion, we should consider refocusing vocational education by (1) focusing on somewhat older and more experienced workers; (2) improving the quality of vocational education through specialization; (3) changing geographic focus to a broader geographic region or to a state; (4) concentrating more on postsecondary vocational education; (5) examining whether secondary vocational education is an aid to the job search process or whether it only distracts students from badly needed math, English, and other core subjects; (6) developing mechanisms for aiding young people's search for work experience, to help them find out what they want to do, that is, developing closer links between school and work for the sixteen to thirty age group that encompasses the search period for most workers.

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Experience of Other Countries

BEATRICE G. REUBENS

18

Responding to Changes in the Demand for Skilled Workers: The Experience of Other Countries

INTRODUCTION

American labor market experts have hesitated to accept the periodic claims of employers and others that actual or potential shortages of skilled blue-collar workers constitute an impediment to production. For example, the National Commission on Employment Policy has not found such shortages when it investigated, and hence, has given a low priority to the need for a public policy on skilled labor. Similarly, the huge defense expenditures looming on the horizon have not provided many warnings from labor market analysts of impending skill shortages, largely because of the substantial reserve of skilled unemployed and reliance on the traditional mobility of American workers and the adaptability of employers. In the same way, the labor force is expected to cope adequately by adjusting to future changes in the structure and requirements of skilled jobs. Few American labor market analysts are calling for an enlarged public role in planning for employment developments or major changes in the education-training system to deal with the quantitative and qualitative aspects of changing labor market demand for skilled workers.

This rosy picture of the United States skilled labor situation is not shared by all. A more negative view has been expressed by Dr. Ulrich Steger, a West German economist and member of the *Bundestag*. After a recent study tour of the United States, he gave an interview covering many aspects of United States economic policy and practice in which he made the following observations:

> I have some doubts whether today's educational system in the United States really is appropriate to meet the challenges of structural change. You produce brilliant scientists, but the performance of the economy depends on middle management with high technical skills, applied engineering, on the skilled worker, the craftsman. Your system falls down in providing technical training and skills when compared with our institutions in Germany. Our apprenticeship programs give those who join the labor market a high degree of skill training, and experience that is missing here . . . . You have to overcome a certain polarization between the extremely sophisticated scientists and the mass of relatively low-skilled people working in the industrial system. You need to build a bridge between pure science and practical application on the factory floor. I don't know whether you can do that without a basic change in education policy. There should be a coherent policy to link the educational system more closely to the economic system. I can't believe that this kind of change can be accomplished just by manipulating the tax system. Even worse, the administration is tearing down the federal agencies which might do something in this area. ("Interview with Ulrich Steger: Piling Up Social Dynamite," 1982, p. 32).

He went on to say that "in the industrial sector, more and more people recognize that a real bottleneck exists within the labor force itself, particularly in the scarcity of middle management with technical skills, engineering technicians and skilled craftsmen."

To the extent that Dr. Steger is speaking of the training of skilled workers, his criticism should be directed to inadequate training in industry more than to a deficient educational system, in light of the division of responsibility accepted in the United States. Greater communication between pure science and the factory floor surely needs to be improved everywhere, but it is not self-evident that other countries, Germany included, are superior to the United States in this area. Nor is it clear that the type of manufacturing in which the United States now specializes requires as high a level of average skill among workers as German (or Swiss) precision manufacturing. However, many interviews and factory visits in the United States and abroad have persuaded me to believe that the United States may have training deficiencies of highly qualified skilled workers, both quantitatively and

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qualitatively. It also should be borne in mind that the advent of numerically controlled machine tools and computerized machinery operations will present a challenge to the German (and Swiss) apprenticeship system, because of their strong reliance on training in small-scale, specialized shops.

Other foreign experts who have compared the United States and northern European countries have presented a somewhat different picture, less influenced by the German bias toward industrial output and more in accord with the self-image cited at the outset. A recent article by Ostry and Koromzay (1982) described the United States as a country where markets play a powerful role in promoting economic adaptation by means of the geographical mobility of production and population, the vigorous entrepreneurial spirit, and great labor market flexibility in which "every measure of mobility—geographic, inter-job, inter-occupation and inter-industrial—is relatively high" (p. 9). The authors (the chief of the Organization for Economic Cooperation and Development's (OECD) Economics and Statistics Department, and a staff member) go on to speculate that the specific nature of the United States service and small-scale manufacturing sectors is responsible for creating

> a reservoir of people with generic "money making" skills rather than the more task-specific "human capital" embodied in industrial employment-generic skills being easier to redeploy from one line of work to another as market opportunities change. Perhaps the educational system, in particular its emphasis on providing opportunities for a rather superficial "higher" education to large number of people through the junior colleges, goes in the same direction . . . . Such "flexibility" as this resource pool of redeployable opportunists generates obviously does not come free . . . .the United States pays a price in terms of lower aggregate productivity growth than in Europe, where specialization, learning-by-doing, and more focused lifetime employment patterns provide greater scope for productivity gains in established channels.The gain, of course, arises when the premium on being able to disengage from established lines and to forge new channels for growth arises. (p. 11)

Despite the differences between the two sets of commentators in emphasis and viewpoint, the OECD authors, like the West German observer, suggest some United States weaknesses. For example, there are obvious training and skill shortage implications for the United

States in the observation of the OECD authors that "a very mobile, get rich quick orientation in the economy generates excessive obsolescence and unduly myopic horizons for business planning . . . ." (p. 12).

These views of the United States by foreign experts suggest that it may be useful to consider how other industrialized countries have responded to changes in the demand for skilled blue-collar labor in the post-World War II period. Their basic situations differed from that of the United States in that virtually every country experienced acute skill shortages in the postwar period of reconstruction and economic expansion. As a consequence, such countries adopted labor market programs to deal with the problem and made specific efforts to adapt the education-training system to the needs of the economy. These countries have also used labor market measures extensively in the period of economic downturn since 1974. Now they appear to be more sensitive than the United States to the implications for the education-training system of expected technological developments and changes in jobs and the occupational structure over the next decade.

Among the reasons that might be cited for this last difference is the relatively greater role of goods production and foreign trade in these industrialized market economies, despite the large postwar increase in the role of foreign trade in the United States economy. For the northern European countries, an important cause of public awareness and action is the accepted greater role of government, since there is a blurring of the "line between what the state provides as a matter of political right and what the private sector provides via the interplay of market forces" (Ostry and Koromzay 1982, p. 11). Greater rigidity of labor markets, pressures to subsidize existing jobs, pessimism about economic and employment growth, and sensitivity to the human costs of a poor adaptation process are specific elements in the northern European concern. Canada, Australia, and New Zealand fall somewhere between the United States and northern Europe as regards the accepted role of government. A quite different situation prevails in Japan, but nevertheless greater attention is accorded to labor force developments by the education and training sectors of these other countries than by their counterparts in the United States.

In some of the industrialized market economy countries, public policy has influenced the training of the skilled labor force in ways that are untried or rejected in the United States. In other foreign countries, the private sector has accepted a wider responsibility for matching the quantity and quality of the supply of skilled workers to the demand.

Again, a comparable situation cannot be found in the United States. While the main elements of the occupational skill training system of the United States are much the same as those in other industrialized countries, countries vary considerably in regard to the balance of elements, as well as the type of clientele, types and locus of training, source of financing, administrative control, the permanence of institutions, and above all, the responsiveness of public policy to an actual or potential change in the demand for various types of workers, which is the theme of this Forum.

This chapter, concentrating on skilled blue-collar workers, inquires whether the measures adopted in other countries to cope with and anticipate an accelerated or diminished demand for skilled labor are relevant or adaptable to the United States, or whether they would improve the responsiveness of American institutions to changing labor market demands. The paper is divided into four parts: (1) the definition and measurement of labor shortages, (2) meeting the shortages, (3) adapting to a period of slack demand, (4) implications for the United States.

DEFINITION AND MEASUREMENT OF LABOR SHORTAGES

Pronouncements that labor shortages are or are not present rarely are accompanied by precise statements of the meaning of the term *labor shortage*. It is highly likely that the term has different meanings in different countries, at different times, and in different industries and regions of individual countries. Strictly speaking, a labor shortage can be said to exist if an output of goods or services, which otherwise would have been produced, is foregone solely because certain labor inputs were unavailable at prevailing wage rates when all other elements of production were readily available. It is assumed that little or no change will occur in the labor-capital ratio, the organization of work, the performance levels of workers, and other factors that might raise the quantity or quality of labor inputs without adding new skilled workers. Such assumptions tend to overstate skill shortages, since employers make adjustments even in the short term.

Labor shortages, so defined, can be brief or extended, affect only skilled workers or all types of workers, plague particular firms or entire industries, and impact on specific localities and regions or permeate the whole economy. Without establishing that all claimed labor shortages actually conform to the given definition one can distinguish three models of skilled labor shortages, drawn from the postwar experience of the industrialized market economy nations. The first involves pervasive shortages of skilled workers in the midst of general labor shortages, with limited visible domestic reserves available for transfer between industries or regions, or for training or retraining. In the 1960s, West Germany and Switzerland faced this situation. The second model, exemplified by Japan in the 1960s, consists of a national scarcity of skilled workers and tight labor markets for all other blue-collar workers, while a substantial labor reserve in the rural population declines as the younger members transfer to urban jobs.

In the third model, specific occupational and geographical shortages of skilled workers are claimed at the same time that large numbers of workers, some of them claiming the same skills, remain unemployed. Canada, geographically far flung and divided regionally, has experienced this situation virtually throughout the postwar period, despite heavy immigration of skilled workers. Many other countries have exhibited such an imbalance since the worldwide downturn in economic activity in the 1970s. This last model implies that labor markets are not adjusting through such means as altered wage differentials, increased training, occupational mobility, and the redesign of jobs to accommodate existing skills. Surveys in several countries fail to show consistent declines in skill shortages as labor markets became looser. However, the coexistence of skill shortages and unemployment must be interpreted with caution, since reports of such shortages may be transitory or reflect the changed training and recruitment behavior of employers in periods of high unemployment (OECD 1982, pp. 51-52, 64).

The measurement of the extent and impact of labor shortages has not been highly developed. Almost all industrialized countries collect and publish vacancy statistics that are an industrial or occupational aggregation of the responses of individual employers to questions about how many additional workers they are currently seeking. A case for a labor shortage might be made if vacancies remain unfilled for a period of time or if the number of vacancies exceeds the number of unemployed in the same occupation or industry, either in the whole country or in a subdivision of it. It is known that employers tend to exaggerate their vacancies and underestimate their options in meeting alleged shortages. Such reporting biases are of varying magnitude from country to country and thus make the absolute levels of vacancies or the number of vacancies in relation to the labor force or the unemployed a misleading cross-national indicator of the severity of labor shortages.

For national purposes, however, vacancy statistics surely are superior to newspaper want ads as an indicator. Vacancy statistics can be more useful if attention is paid chiefly to month-to-month changes in the levels, on the assumption that reporting biases remain fairly constant. Comparisons between fluctuations in the vacancy index and changes in the unemployment rate are used to indicate the tightness of labor markets, either overall or for specific types of workers, occupations, industries, areas, or demographic groups (GB 1980). It should be noted that such measures do not reveal whether output has actually been foregone.

A statistical method designed to check on foregone output was introduced in West Germany in the early 1950s. Using this method, firms are questioned as to whether their output was hindered or disrupted by a shortage of labor in a given time period. Results are published as the proportion of firms reporting labor shortages that affected output. A parallel series showing the percentage of capacity at which each industry is operating has displayed the expected correspondence with the employers' responses on labor shortages, conferring validity of the latter (Friedrich and von Henninges 1982). However, no direct check has been made of the accuracy of employers' responses. These German data do not distinguish skilled worker shortages from other labor shortages, nor do they measure the amount and types of labor sought; some of this information can be adduced from the German vacancy statistics. The German data, showing both seasonal and cyclical fluctuations, exhibited a strong rise in level at the end of the 1950s when 50 percent of the firms declared that labor shortages were impeding output; in July 1960 a high of 62 percent was recorded (Kindleberger 1967, p. 35). After 1965, the level receded, although as recently as 1980, 45 percent of the firms in the steel industry reported that labor shortages caused serious production interference (Friedrich and von Henninges 1982, p. 13).

Other countries have run special surveys of skill shortages on occasion. A Canadian inquiry in 1980 found that 49 percent of the firms had problems in recruiting skilled workers from 1977 to 1980, and 43 percent anticipated continuing difficulties in the four years to come (Betcherman 1980). In a Japanese study, a sharp decline was shown from 1973 to 1980 in the shortage of skilled workers; shortages were reported mainly by small enterprises and were almost absent in firms employing 500 or more workers (Japan 1980). Australian concern centers on shortages of skilled workers trained in the apprenticeship system, especially to meet the expected boom in natural resource exploitation. Periodic surveys of skill shortages by the British Department of Employment measure both the number of firms reporting such shortages and the number claiming that production or expansion has been adversely affected; both indicators have shown a drop since 1978, according to reports in the Department of Employment *Gazette*.

The official agencies of the United States are unusual in that they do not collect vacancy statistics or poll employers on a regular basis. The job orders placed by firms with the U.S. Employment Service are sometimes used to indicate skill shortages or trends, but this is statistically invalid for analyzing levels or year-to-year changes because these job orders are estimated to cover only 10 to 15 percent of all job openings and even less for skilled workers (Rosenthal 1982, p. 34-35). In 1980, Massachusetts conducted a pilot survey of job vacancies in an effort to determine whether a longitudinal data analysis format like that used by the Germans was feasible. Although the survey yielded some expected and some useful information, the likelihood of producing a federal vacancy series on a regular basis is small, given the anticipated expense, the inconsistency of occupational definitions in current use, the unreliability of employers' responses, and the development of an alternative official statistical database—the OES (Occupational Employment Statistics Survey), from which calculations and projections can be made (Rosenthal 1982, pp. 31, 34-35). If a national pilot survey were to be made by a federal agency, the skilled machining occupations or related occupations in that category probably would be the prime candidates for such an experiment. However, such pilot employer surveys and data collection should be delayed until some time after all federal statistical programs have adopted the consistent occupational definitions of the Standard Occupational Classification (SOC) introduced by the Office of Management and Budget (OMB) in 1980, and after employers have become familiar with the definitions (see the chapter by Harold Starr "Vocational Education's Response to Skilled Industrial Worker Shortages").

None of the available data on labor shortages in other industrialized countries establish whether firms took all available steps to end the declared labor shortage, nor is there any objective verification of employers' reports or a calculation of the amount of foregone output. To purists, it may seem that some of the reported labor shortages, even in the 1950s and 1960s, simply reflected a tightening of labor markets. For present purposes, these distinctions are not important. An accelerated demand for labor has usually been sufficient

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to trigger private and public policy responses, especially when unemployment has been very low. These responses, to be examined in the next section, have not only dealt with the immediate situation, but have also provided a framework for semipermanent and adaptable labor market institutions. These have been utilized to cope with the current period of slack labor demand and are the basis for planning for possible future changes in the quantitative and qualitative demand for skilled labor.

MEETING THE SHORTAGES

The skill and other labor shortages that confronted the western European countries and Japan, beginning in some cases in the 1950s and in others in the 1960s, had not been anticipated. As nations proceeded with the reconstruction of the wartime devastation or, like neutral Sweden and Switzerland, experienced economic growth at an unparalleled pace, they found that they were unprepared for peacetime labor shortages. Few of their institutions were ready to respond. The outstanding lesson of this period is that a long lead time is required to design, enact, staff, and make institutions or programs operational. A still longer period is needed to have them function effectively. Moreover, workers acquiring skills through training and retraining will not be ready to work for some time and so may not be relevant to the shortages that stimulated their training.

The initial burden of dealing with immediate shortages, therefore, fell largely on the individual firms, some of whose solutions, such as hiring away the workers of another firm, only transferred the burden to less competitive firms and added inflationary pressures to the economy through "wage drift," that is, the rise of earnings beyond the negotiated contract or the stipulated level set by incomes policies. Firms undoubtedly decided to increase and improve their own training programs for this reason, but this effort, largely unrecorded, usually was not on a sufficiently large scale and took time.

Japanese employers had a particularly difficult time because their preferred pattern was to recruit young people directly from school for training within the company as skilled workers. However, the great increase in the demand for such youth occurred just as demographic and educational enrollment trends depleted the available supply (Reubens, Harrison, and Rupp 1981). Reluctantly, employers began to recruit young workers from other companies, but they were not given the status, pay, or training offered to new recruits from school. In order to maintain a semblance of order in this tight labor market for youth and to assist the young people, the public authorities and schools exercised a high degree of control, requiring employers to signify in advance how many youths they wished to hire and arranging interviews and placement of youths (Reubens 1977). These measures have since become permanent features.

In this early period, public policy in most countries did not deal directly with the private sector's attempts to solve its skill shortages. In recent personal correspondence on this issue, a West German labor market expert indicated that German firms, on their own, restructured their jobs and fostered upgrading, training, and occupational mobility in order to produce enough native, skilled workers so that the numerous vacancies for unskilled and semiskilled workers could be filled by foreign "guest" workers. To some extent, this pattern was repeated in other countries, although Japan relied entirely on a native labor supply, drawing labor from the farms to industry.

Would this European use of "guest" workers have any parallel in the United States with regard to legal immigrants or undocumented workers? Short of a war emergency, it is difficult to foresee a United States skilled labor shortage of such magnitude or a reserve of unskilled or unemployed labor as small as European countries faced in their period of rapid economic growth after World War II. If United States employers wish to expand their skill training by upgrading semiskilled and unskilled workers, they can do so without relying on foreign workers to fill these manufacturing jobs, since natives will readily apply in most industries. There is, in fact, some evidence that American employers have responded to skill shortages by increasing training. In the case of machinists, much of employers' on-the-job training is not recorded in new apprenticeship registrations, mainly because employers prefer shorter training and other arrangements contrary to the official regulations (Rosenthal 1982, pp. 33-34).

The public effort in other countries consisted of several types of measures, with varying emphases, timing, and administrative forms in different countries. An early and persistent attempt was made to improve the "transparency" of the labor market, as the Europeans say, meaning the matching of supply to demand. This involved strengthening of the job-matching functions of the public employment service, even to the point of requiring employers to report all their vacancies to the employment service, prohibiting or controlling private employment agencies, and denying unemployment benefits to those refusing suitable jobs (Reubens 1975). Other efforts to improve the functioning of external labor markets involved reinforcement of information and counseling services and various aids to the geographical mobility of workers and jobs. Later appraisals cast doubt on the efficacy and durability of assisted mobility to workers, but it continues to have its supporters (OECD 1982, pp. 52-53, 103).

The use of skill training and retraining for adults under public auspices was a major development in several countries, notably in Sweden, France, Great Britain, and the Netherlands (Reubens 1972). When expanding existing public training centers and starting new systems, these countries concentrated their training courses in the fields of greatest labor shortage and did not hesitate to "cream" the best candidates from among the unemployed or other designated target groups. Japan also established public training centers, but they operated mainly as a complement to the training offered in internal labor markets, primarily serving the small firms with inadequate training and emphasizing general skills in contrast to the firm-specific skills characteristic of employer training (Reubens 1973a).

Sweden's large training system was a coherent part of its "active manpower policy," designed to supplement macroeconomic policies and to remove the skill bottlenecks that undermined output and price stability (Reubens 1972; Hjern 1980). Observers have given high marks to (1) the performance of the Swedish training centers and the training sponsored in other settings which is possible because of the flexible, permanent, and generous financing by the central government; (2) the flexibility of training courses in length, timing, and composition; and (3) the strong and effective local initiatives in providing courses relevant to the needs of local labor markets. In addition, the program has benefitted from the active participation at national, regional, and local levels of representatives of employer organizations and trade unions, along with government. The collaboration has included the areas of policymaking and day-to-day operations, administrative coordination, and support from related agencies. The result has been high job placement and retention rates of trainees (Hjern 1980; O'Toole 1979).

The German response, in the Labor Promotion Act of 1969, provided public financing, but did not establish public training centers. Instead, generous financial incentives are now offered to individuals, whether employed or unemployed, to encourage them to seek basic or

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advanced vocational training or retraining. These programs were intended to ensure or improve occupational flexibility, foster occupational advancement, meet shortages of skilled workers, and prevent or reduce unemployment and qualitative and quantitative underemployment. At the same time, loans or subsidies for building and equipment costs have been available to nonprofit training institutions under the direction of such groups as the German Chambers of Trade, Industry, or Agriculture; employers' or workers' associations; welfare clubs; and similar groups. While the curriculum, length of courses, teaching methods, and qualifications of the staff or institutions receiving loans or subsidies were expected to aid in producing high quality training, no specific provisions were made to police the quality of training programs. Any contribution by the program to a reduction in skilled labor shortages has not been stressed or quantified. However, individuals reported satisfaction with the outcomes in terms of advancement in their careers (Germany 1980, p. 70).

Many of the countries were motivated by the skill shortages to give attention to the expansion and reform of public vocational education for youth. In many cases the reforms did not take effect during the period of labor shortage and had their initial impact during a period of contraction in labor demand. To a much greater extent than in the United States, these countries have stressed the need to make vocational training as prestigious as academic education, to ensure that every level of education includes substantial vocational elements, and to match, nationally and locally, students' educational choices with their later occupational opportunities. Pathways have been provided for vertical mobility in all sectors of education and mechanisms have been established at all levels for revising and adapting the content of vocational courses in light of changes in the jobs and the organization of work. All of these developments merit serious consideration in the United States.

Public investment in higher education, which also expanded on a very large scale during this period, was in part attributable to the recognition of a shortfall in the number of persons with advanced skills suitable to the changing postwar economy. The United States generally has a more flexible and responsive higher education system than most of the other nations.

Great Britain was an outstanding exception to the generalization that most countries did not seek to increase the amount of training by employers in the years of acute skill shortages. British legislation in 1963 created the Industrial Training Boards (ITBs) to which designated firms had to belong and a levy-grant system that was intended to induce employers to offer more and better training; they could thus recoup as a training grant the money they had paid as a levy to their training board. The overall assessment is that the quality of training has been considerably improved by the ITBs, but that the quantity of trainees has not been increased as was hoped. Employers continue to train the number they thought warranted by immediate economic needs and prospects, unless they were offered direct training subsidies, as occurred after the 1973 Training Act created the Manpower Services Commission. Under the Thatcher government, most of the ITBs are being dismantled, to be replaced by voluntary efforts in each industry. However, the pioneering of the levy-grant system of Great Britain has had its impact elsewhere. Ireland and the Netherlands have established similar systems, and Canada, Australia, and New Zealand have discussed the need for a levy-grant training system.

A related financing device is used in France. Employers' payrolls have been taxed since 1971 to provide a fund for training; however, the obligation to pay the tax can be reduced or eliminated according to the amounts spent by the firm on training within the organization or in outside training institutions. This type of financing had been introduced earlier in the form of an apprenticeship tax, the proceeds of which were used in part to construct special centers to improve apprenticeship training. The broad-ranging French measure passed in 1971 permitted persons regularly employed for a stipulated period of time to take paid leave in order to enter a wide variety of training or educational courses, usually of short duration. Naturally, employers have promoted skill courses that would increase the value of the workers to the firm, while workers have expressed a desire for a wider variety of courses, including courses in politics, languages, and leisure-time activities. A large profit-seeking training industry has grown up around the 1971 law, supplementing the nonprofit sector which also expanded. In other countries, laws have been passed providing paid educational leave, following the lines of the recommendation of the International Labor Organization. The potential contribution of these measures to meeting skill shortages remains to be tested.

The apprenticeship system is still another aspect of the private sector's training system that has been affected by public policy. Public subsidies to employers who increased their apprenticeship intake were provided in several countries, mostly English-speaking nations

(Reubens 1980). Avoiding this approach, Switzerland and Germany concentrated on qualitative improvement. Switzerland tightened the standards for on-the-job training and extended and improved the off-the-job components (Switzerland 1980, vol. 2, pp. 244-276). The German training law of 1969 aimed to accomplish many of the same apprenticeship reforms as the Swiss changes, but it was roundly criticized as poorly enforced and not doing enough for apprentices, the "forgotten majority" for whom a full-time education was sought instead of apprenticeship. For their part, German employers fought full and early enforcement of the new law on the grounds of increased cost and diminished authority (Reubens 1973b). The government was gradual and moderate in its enforcement efforts, especially as the focus began to shift in the 1970s from meeting immediate skill shortages to adapting to rising unemployment and preparing for future skill shortages.

ADAPTING TO A PERIOD OF SLACK DEMAND

In most countries the programs adopted to cope with the skill shortages of the 1950s and 1960s either were in use for only a brief period of time or had just been introduced when extremely tight labor markets were replaced by growing slackness. So much time had elapsed in the gestation, enactment, and implementation of the measures, while the period of skill stringency had been fairly limited, that, in most cases, there scarcely was a basis for evaluating the efficacy of the institutions and programs in reducing skill shortages. Instead, their utility could better be judged by asking whether these institutions and programs could be and were adapted to the prevailing slack labor markets, since this would save the valuable time that had been lost earlier when skill shortages were the leading issue. On the whole, a positive answer can be given. It also can be assumed that these countries will be able to adapt the same institutions and programs in the future to deal with further changes in the demand for labor.

The most striking adaptation to rising unemployment was in the size and participant characteristics of the permanent training programs. Expansion of training capacity and intake and a shift to less qualified trainees, disadvantaged persons, foreign workers, and so forth characterized the programs in most countries since the mid-1970s. While skilled workers who lost their jobs or whose occupations seemed to be facing permanent decline were fully eligible for training or retraining, the earlier mentioned groups came to comprise a large portion of the training population. In some cases, though, as in

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Germany, the original overrepresentation of more qualified persons in training programs continued and was a source of criticism. An official report declared that the 1969 training initiatives "can be argued to have standards which are too high, insufficient incentives, general education barriers and some institutional and organizational faults, and [are] not sufficiently oriented to persons with low qualifications" (Germany 1980, p. 70).

The total number entering this type of German training also was disappointing because employed persons were reluctant to leave jobs to take training due to the scarcity of employment opportunities. Between 1972 and 1979, the proportion who had been unemployed before entering training rose from 5.8 to 42.9 percent, but the employed still dominated (Germany 1980, pp. 68-74; Hofbauer 1981, pp. 248-249). Training centers in other countries had previously served and continued to serve unemployed persons overwhelmingly. Even with rising unemployment, fairly high rates of placement and retention were recorded, especially if local selection of the training courses dominated (Hjern 1980).

With the intensification of unemployment, most of these countries found the existing roster of labor market measures inadequate. They strengthened existing programs and added new programs whose life was either fixed or would terminate with economic improvement. Germany, for example, added training for unemployed persons as well as job creation. A succinct statement of German criteria for determining participation in special programs for the unemployed is of interest in the American context:

> While earlier programmes were designed for specific target groups, greater improvement has now been achieved by making the length of unemployment the most important criterion of manpower policy for particular groups . . . . This avoids social discrimination and facilitates the construction of the programme. It is the most effective means of counteracting the "structuralization" of unemployment. (Germany 1980, p. 38)

In spite of greatly increased expenditures on employment measures, the share of total labor market expenditures devoted to unemployment benefits has greatly exceeded that spent on employment measures in almost all countries. For example, in Germany, 61.8 percent of the Federal Employment Institute's expenditure in 1977, a year of high unemployment, was for unemployment benefits of various types and only 38.2 percent was for a wide range of employment programs. In 1970 when unemployment was negligible, not only had the balance been reversed, with less than one-fourth of the total spent on unemployment benefits, but the total amount of expenditure was vastly lower (Germany 1980, table 12). Therefore, except perhaps in Sweden, passive cash payments to unemployed persons have been the more usual response rather than employment programs, in spite of demonstrations that the latter are less costly to government (Germany 1980, pp. 25-67).

In the period of elevated unemployment, many countries continued to record skill shortages. Reinforced efforts were made to have the public placement service bring demand and supply together. In addition, more countries introduced subsidies to apprenticeship recruitment and training or increased and extended existing subsidies (Reubens 1980). Other skill training in firms was also subsidized in an effort to maintain jobs (Hjern 1980). The Manpower Services Commission in Great Britain offered financial incentives and aid to industry to stimulate training that had been foregone in the economic downturn, including hiring of additional apprentices. In Germany support was given to training centers outside firms so that more apprentices could be taken on and given better training. With the emergence of youth unemployment in Europe in the mid-1970s, there was a new appreciation of the work-study approach for youth, exemplified in apprenticeship. The German critics of apprenticeship took more moderate positions or became advocates of a system that, under government pressure, expanded to absorb the baby boom cohorts even as employment openings fell.

A recent study provides an interesting account of how German firms met their skill shortages in 1980. Public programs are not mentioned, apart from the employment service to which government-financed trainees would go for jobs and which firms used heavily in their effort to recruit skilled workers (Friedrich and von Henninges 1982, pp. 14-17). Continuing shortages in the face of a large supply of trained workers are caused by structural problems that involve the period of apprenticeship as well as the subsequent employment of those who complete training (Friedrich and von Henninges 1982, pp. 17-19; Germany 1980, pp. 112-139). If anything, the problems may have been intensified by the government's success in enlarging the number of apprenticeship places beyond the level that German firms would have offered had there been no pressure on them. Disparities between the fields in which young people desired to train and their actual apprenticeships were intensified, as was the mismatch between the occupations for which training was being offered and the occupations requiring skilled workers. Offsetting these faults was the reduction in immediate teenage unemployment achieved through additional apprenticeships, the superior employment position of a youth with vocational training, no matter what the field, to that of one without training, and the preparation for future skill shortages.

Interestingly enough, the German government has sold employers on the expansion of apprenticeship during a slack period as being in their own self-interest, because ten years hence there would be severe skills shortages due to a declining number of young people in the population. It is fairly typical that countries which have accepted a strong public role in employment stimulation and have adopted permanent labor market institutions and programs should plan for possible future skill shortages while coping with slack demand (e.g., Canada 1981, 1982; Germany 1980). In addition to a concern that, among other categories of labor, the number of skilled blue-collar workers may be inadequate for future needs, there also are attempts to plan for required changes in the content of skill training due to increased use of numerically controlled machine tools, computer-assisted machinery, robots, and other technological advances.

The impact on the longer term relationships among the numbers and tasks of the various occupational levels—unskilled, semiskilled, skilled workers, technicians, technologists, and professionals—has been an important part of the official discussion and planning. Underlying the training response is a commitment to the restoration of full employment, accompanied by concern about the problems in achieving it and fears that individual countries may be unable to carry out programs if other nations follow a divergent course. For the most part, however, the faith in tried labor market measures remains strong, at the same time that newer ideas, such as worker participation in management, improved and safer work environment, and protection against technological displacement receive greater attention (OECD 1982).

IMPLICATIONS FOR THE UNITED STATES

It can immediately be argued that the experience recounted in this chapter is irrelevant to the United States inasmuch as the specific issue of skill shortages has not arisen. Given a reasonably successful adjustment of supply to demand, why look for new programs? But there is another side. As long as there is no accepted system for identifying skill shortages or projecting future shortages, there is the chance that a serious situation might develop even while controversy rages over whether there are shortages. The lead time required to train new workers or introduce labor-saving technology may cause a loss of output. After a survey of the information on the United States' shortages of machinists in the 1970s, the chief of the Bureau of Labor Statistics' Occupational Outlook Division concluded that the data were consistent with the existence of shortages, but he was unable to quantify its extent. Looking ahead, he stated that "if defense purchases were to rise rapidly during a short time frame and affect industries in a specific area, the shortage could become so acute that the planned increases in production could not occur" (Rosenthal 1982, p. 36).

Perhaps this threat is not enough to make policymakers change their stance, especially if they expect geographical mobility or other market responses to ease the situation. However, a case also can be made that past methods used in the United States to respond to changes in the demand for skilled workers may not be adequate in the future. To begin with, it is not absolutely clear that the apparent American avoidance until now of the labor shortages experienced by other industrialized countries has been accompanied by the most efficient and equitable operation of the labor market or the best types of training. To the extent that provision of a larger number of and more effective permanent training and employment programs and institutions might have improved the earlier situation, the record of the United States is less than optimal. Furthermore, a higher value may be set on efficiency and equity in the United States in the years to come due to the pressures of foreign competition, the financial stringency affecting training institutions, and the expectations of the work force. Also, altered circumstances may lead to skill shortages in the United States, since beyond any doubt the same changes, for which other countries have begun to plan, will occur in the United States in the allocation of tasks to skilled workers.

Which specific policies and programs of other countries might improve United States skill training and are they suited to American conditions? The role of high school-level vocational education in preparing for the skilled blue-collar trades is well established in other countries. Increasingly, such school courses contain a period of work in a firm; Sweden uses this system extensively. Several major Japanese companies interviewed by this author spoke of hiring directly from vocational high schools with the knowledge that general trade skills would have been imparted. In France, hiring graduates directly from vocational high schools for placement in jobs that lead to skilled positions is the normal procedure. In the United States, vocational education programs in the skilled blue-collar trades, whether at the high school or higher level, are often regarded only as introductory or preparatory to apprenticeship or other training (Rosenthal 1982, pp. 33-34). It should be possible to make United States vocational education for skilled occupations a true parallel to apprenticeship in the United States by making on-the-job training an important part of the course. Employers might accept their part in such a system if they were reimbursed for all net additional expenses, as is done in Denmark and Sweden.

It is likely that school-based training will have an increasingly important role to play as skilled manual worker jobs are converted to jobs for technicians and workers are assigned to numerically controlled machine tools or the operation of several machines at once. Traditional apprenticeship may be an outdated method of preparation, especially without paid release for a block of weeks or months for the theoretical training, as is common elsewhere.

A strong point of labor market policy in a number of western European countries is the utilization of a quasi-public, tripartite body (representing, at a minimum, government, employers' organizations, and trade union federations) as the permanent, centralized policy and administrative body for implementing employment and training measures and coordinating with education and social programs. This form has proved so useful in Great Britain that the Conservative Government not only has left the Manpower Services Commission (MSC) in place, but also has continued and enlarged financial support for the programs MSC administers, even while maintaining a stance of reducing the role of government in the economy.

The establishment in the United States of a government body, like those in West Germany and France, to study changes in jobs and occupations and devise and institute appropriate changes in training, whether in schools or on-the-job, would be desirable. If such an organization had influence and status, it might begin to bridge the gaps between vocational education, apprenticeship, and other employer skill training.

Large American corporations and public utilities whose training facilities and methods are of high quality might be subsidized to expand their training capacity beyond their own needs in order to train skilled workers for other companies, as has been done in several countries. The financing of such excess training could be through contributions from the firms hiring these trainees, the government, or a combination of several sources. Such training places could be increased in recession periods when foregone earnings for trainees are low because jobs are scarce. As a measure for unemployed persons, such training has drawn public financing in European countries. Because the registered apprenticeship system in the United States is so heavily dominated by the construction occupations and for other reasons, it is this author's belief that attempts to encourage and enlarge employer-based training in nonconstruction occupations should not be based on participation in registered apprenticeship. Naturally, any program to enlarge employer skill training through financial assistance should be based on the development of skill shortage surveys and forecasts, no matter what source is used to derive the estimates.

Paid educational leave would have to be much longer than it usually is at present, if it is to make a substantial contribution to skill training; but it merits further inquiry. Based on the experience with CETA, a system of public training centers targeted to disadvantaged persons would not produce skilled workers, but might prepare some people to enter employer training. It is possible for employers and their organizations to establish industry-wide training centers that focus on skill training and complement on-the-job training, as is now quite common in Great Britain, France, and Germany. These are basically financed by industry and would seem to be both feasible and desirable in the United States. Possibly the Private Industry Councils of CETA could stimulate their establishment.

These are some of the measures used in other countries that seem relevant to improving the quantity and quality of American skilled workers. It would be misleading to suggest that no one in the United States is advocating the type of measures other countries have adopted. Senator Bill Bradley, in a *New York Times* article on June 24, 1982, dealing with the greater interdependence among national economies and the growing competition from other countries, had the following suggestions on training and employment:

> Workers will have to command a constantly growing supply of information. Some jobs will be created, others will disappear.

> Today, 30 percent of the G.N.P. comes from manufacturing; in the year 2000, that percentage will be the same, but it will be achieved with 15 million fewer workers because of increased use of technology that will make production more efficient, easier, cleaner and safer.
>
> We can prepare for this advance by helping workers upgrade their skills and gain additional education. One way might be to create an insurance program under which workers displaced by technology or foreign competition could cash in their policies and use the money to acquire new skills.
>
> Our educational system must meet the growing demand for technical expertise while instilling humane, democratic values. The Government can join business and educational institutions in establishing scholarships for students preparing to teach critical skills such as math, science and foreign languages.
>
> As technology takes over manual work, employees will be most effective as managers of the production process. They should increasingly participate in management and ownership of companies. Quality-of-work circles, membership on board of directors, and various forms of profit-sharing will affirm to workers their value to their companies.
>
> Employee stock ownership plans offer a true prospect for democratic capitalism. No such innovations can succeed unless management and labor, working as a team, treat them as opportunities instead of threats.*

If substantial support can be garnered for sentiments such as these, the experience of foreign countries discussed in this paper suggests that a wide variety of choices is open to the United States with regard to the type of specific measures to be adopted, the groups to be emphasized as participants, the manner of financing measures, the locus of authority, the degree of reliance on the private and public sectors, the extent of participation by employers and trade unions in public policy formulation and execution, and the degree of local initiative and control. Above all, a review of the diverse experience of other countries indicates the importance of matching policy and programs to the particular circumstances and needs of each country.

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C. MICHAEL AHO

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The Experience of Other Countries: Reactor Comments

Beatrice Reubens' chapter presents a rich menu of questions and issues regarding adjustment and training policies. In a world of budgetary restraint, it is difficult for any society to support social experiments. Therefore, it would benefit those in the United States to evaluate the experiences and evidence from other countries to learn about the different approaches to labor market adjustment problems they have tried. Although we may not choose to imitate or develop these programs in our own country, we may find aspects of them that can be put on our own agenda of adaptations for dealing with adjustment problems.

Although Dr. Reubens focuses upon shortages of skilled workers, I would prefer to return to the traditional labor economist approach, focusing instead upon inconsistencies in the labor market rather than shortages. In the coming decade, both labor market shortages and surpluses will occur. What may be needed in both cases is an adjustment program or skills training program that will prevent workers from being idle after layoff. Such programs would allow workers to move to occupations most productive for both them and the economy. They would prevent shortages of skilled workers and the wage drifts associated with them.

I am going to take the liberty now of speculating about the future and explain why I think adjustment problems could become the paramount political question in this decade.

In the 1970s, there was a convergence of industrial structures among the industrialized nations. Now, the major countries are competing as equals in exactly the same industrial sectors. Meanwhile, competition from the newly industrialized countries has been increasing, again putting pressure on the traditional industries of the already industrialized countries. These forces are going to intensify during the 1980s, and their presence clearly points to the need for labor market adjustment in the various countries.

During the 1970s, the importance of trade as a percentage of the gross national product doubled in importance. In the late 1960s only one out of every fourteen workers in manufacturing was involved in manufacturing exports. Now, roughly one out of every seven manufacturing workers in the United States is involved in manufacturing exports. This increasing importance of trade to employment is having an effect on the composition of the United States labor force. Exports are escalating, but import competition is also increasing. The changes in the demand for skilled workers can be directly associated with these changes in trade patterns (Aho and Orr 1981). The export industries employ highly skilled individuals who are generally better trained, better educated, and more highly paid than average manufacturing workers. The workers who are adversely affected by changes in trade, those affected by imports, tend to be more disadvantaged in terms of their labor market experience, their education, and their skills. Further, as Charles Dale discussed, the expansion of the defense industry has increased the demand for those same highly skilled workers now being demanded by the export industry.

The shortages that Dr. Reubens addressed in her chapter are most likely to be in the highly skilled categories. At the same time, the skills of workers in import competing industries are becoming obsolete, making training and rehabilitation necessary for getting those workers back into the work force.

The pace of structural change will not slacken in the 1980s, especially since technological changes will make the skills of many workers superfluous. In particular, the introduction of new technologies spawned by the revolution in microprocessing and robotics will most likely accelerate the changes in our industrial base. The automation debate of the 1960s suggested that technological changes need not have adverse employment effects, as long as the economy is expanding. But in the current environment of slow growth and increasing competition in our traditionally labor intensive industries, it is vital that labor markets function as flexibly and efficiently as possible. Failure to adjust to these labor market changes will cause prolonged unemployment and social strain, as well as reduce the prospects for growth over the long term.

The changes in technology will pose major challenges for collective bargaining. There is a trade-off between security for the workers and flexibility of the economy as a whole. The collective bargaining framework needs to be broadened so that employers take more responsibility for retraining workers and for shifting them to new occupations. Then workers can be more secure that they will have jobs, and they are likely to be more productive as a result.

Demography has not been mentioned at this Forum, but part of the solution to skilled worker shortages in the past has been new youth entrants to the labor force. The young are often more mobile. However, fewer young people will be entering the labor force in the 1980s, which increases the possibility of skill shortages. An important question thus becomes whether we can fulfill these shortfalls with the veteran workers who simply need skills upgrading or who have been displaced by import trade. This will be a major challenge for our country, because in the absence of alternative opportunities, these adjustments will be resisted either within the firm, or at a political level in the case of dealing with import competition.

To resist the needed adjustments would only harm our economic welfare in the long run. For this reason, we need an adjustment policy that facilitates the transition, shifting workers from less productive to more productive occupations. This would help increase the growth rate in the United States, which in turn would facilitate further adjustment. What the United States needs is to focus more attention on vocational education and training systems to assist in the adjustment.

A problem in our system, especially where international trade is concerned, is that our system reacts to political pressure. We need an adjustment program that will help us facilitate exit from declining industries. If the structural change is due to import competition, we need to shift workers from those occupations to more productive ones in other industries. In the United States. however, increased competition from other countries normally results in greater political pressure for protection, which is detrimental for our society as a whole. How can we design an adjustment system that will compensate workers, but will also have some mechanism for preparing them to move into other occupations? Such a system would free up workers and investment and managerial resources, which could then be shifted over to more productive industries.

We need an adjustment program that maximizes adaptation to a changing environment rather than reliance on protective tariffs. One such attempt was the trade adjustment assistance program (Aho and Bayard forthcoming). This effort was a failure. It was costly and did not really emphasize adjustment. In a period of budgetary restraint, we must learn how to incorporate the private sector into the adjustment process, either through the use of vouchers, tax write-offs for on-the-job training, or other means. How can the private sector become more responsive to the adjustment process? Senator Bradley's suggestions that Dr. Reubens mentions in her chapter rely quite heavily on the use of the market system and are worth considering.

The proposals for enhancing the role of high schools and vocational schools will help increase the supply of skilled workers. But we must remember that unless we orient the vocational schools to including adult learners, these methods would only help the young, not the older, veteran workers.

Expanded use of private sector training facilities may be one possible way of training and retraining adult workers. In fact, if the government were subsidizing the facilities when they would otherwise be idle, it might be an incentive to the private sector to expand the facilities already in existence.

In conclusion, Dr. Reubens has presented us with a rich review of foreign experiences, some of which may be suitable for inclusion on our agenda for the future, all of which we can learn from in terms of broadening our outlook. As befits a research director and former academic, I heartily endorse more research on foreign experiences with adjustment programs. In addition to analyzing how the education or training was administered, this research should include detailed microeconomic statistical analyses of how these programs affect labor market outcomes. The rising public debate over unemployment and adjustment could use more hard evidence on the effect of alternative labor market policies. Foreign experiences could serve as a valuable source of such information.

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List of Participants

C. Michael Aho
U.S. Department of Labor
Office of International Economic Affairs
International Labor Affairs Bureau
Washington, DC

Ray Adcock
Department of Economic and Community Development
Annapolis, MD

Sarah Babson
U.S. Department of Education
Office of Vocational and Adult Education
Washington, DC

Stephen E. Baldwin
National Commission for Employment Policy
Washington, DC

Paul Barton
National Institute for Work and Learning
Washington, DC

John A. Bell
National Tooling and Machining Association
Ft. Washington, MD

Robert Biugns
Operation Second Chance Inc.
San Bernardino, CA

Paul Braden
U.S. Department of Commerce
Washington, DC

Ralph Bregman
National Advisory Council for Vocational Education
Washington, DC

Herrington Bryce
National Policy Institute
Silver Spring, MD

Ronald B. Bucknam
National Institute of Education
Washington, DC

Jill Casner-Lotto
Work in America Institute
Scarsdale, NY

Pat Choate
TRW
Washington, DC

Bayard Clark
U.S. Department of Education
Washington, DC

Garrett V. Coleman
U.S. Department of Education
Office of Planning, Budgeting, and Evaluation
Washington, DC

Richard V.L. Cooper
Coopers and Lybrand
Washington, DC

Ellis Cose
USA Today
Washington, DC

Robert L. Craig
American Society for Training and Development
Washington, DC

Ed Czarnecki
AFL-CIO Education Department
Washington, DC

Charles Dale
U.S. Army Research Institute
PERI-GP
Alexandria, VA

Jacqueline P. Danzberger
Youthwork, Inc.
Washington, DC

Gary R. Darlington
Skills Training Center, Job Corps
AFL-CIO Appalachian Council
Pittsburgh, PA

Henry David
National Institute of Education
Washington, DC

Robert M. Decker
Appalachian Regional Commission
Washington, DC

Paul Delker
U.S. Department of Education
Washington, DC

Donald P. Devey
IBM
Armonk, NY

Becky Dickinson
Manpower and Vocational Education Weekly
Capitol Publications
Arlington, VA

Richard DiEugenio
Senior Legislative Associate
Committee on Education and Labor
U.S. House of Representatives
Washington, DC

Mary Eccles
Joint Economic Committee of the U.S. Congress
Washington, DC

Ken Edwards
International Brotherhood of Electrical Workers
Washington, DC

Joseph B. Epstein
Social Science Research Council
Washington, DC

Rupert Evans
University of Illinois
Champaign, IL

Paul O. Flaim
Bureau of Labor Statistics
U.S. Department of Labor
Washington, DC

Russell B. Flanders
National Occupational Information
Coordinating Committee
Washington, DC

Stephen J. Franchak
The National Center for Research
in Vocational Education
The Ohio State University
Columbus, OH

Richard Freeman
Department of Economics
Harvard University
Cambridge, MA

Russell Freeman
California Institute of Technology
Pasadena, CA

Evelyn Ganzglass
National Governors Association
Washington, DC

Sandra Garcia
U.S. Department of Education
Education, Research and
Improvement
Washington, DC

Lonny D. Garvey
National Tooling and Machining
Association
Ft. Washington, MD

Alan Ginsburg
U.S. Department of Education
Washington, DC

Woodrow Ginsburg
Center for Community Change
Washington, DC

Louis Godla
U.S. Department of Education
Office of Vocational and Adult
Education
Washington, DC

Robert Goldfarb
Department of Economics
George Washington University
Washington, DC

Harold Goldstein
Manpower Research Associates
Bethesda, MD

Tom Granzow
Aurora Associates
Washington, DC

Frances Grice
OSC School of Opportunity
San Bernardino, CA

John A. Hansen
MIT—Center for Policy
Alternatives
Cambridge, MA

Gisela Harkin
U.S. Department of Education
Office of Vocational and Adult
Education
Washington, DC

Richard M. Hausler
Appalachian Regional Commission
Washington, DC

Gerry Hendrickson
U.S. Department of Education
Office of Planning, Budgeting and
Evaluation
Washington, DC

Peter Henle
Arbitrator
Arlington, VA

Laurabeth H. Hicks
U.S. Department of Education
Office of Vocational and Adult Education
Washington, DC

Patricia Hogue
National Commission for Employment Policy
Washington, DC

Charles O. Hopkins
Oklahoma State Department of Vocational and Technical Education
Stillwater, OK

Don Hopkins
Corning Glass Works
Corning, NY

Michael P. Huerta
Coopers and Lybrand
Washington, DC

Richard A. Johnson
U.S. Department of Commerce
Economic Affairs/OPT I
Washington, DC

Evelyn R. Kay
National Center for Education Statistics
Washington, DC

Ann Kibler
U.S. Department of Education
Office of Vocational and Adult Education
Washington, DC

Deborah Klein
U.S. Department of Labor
Bureau of Labor Statistics
Washington, DC

Charles Knapp
Tulane University
New Orleans, LA

Thomas J. Kniesner
Council of Economic Advisers
Washington, DC

Ronald Kutscher
U.S. Department of Labor
Bureau of Labor Statistics
Washington, DC

Edward J. LaMontague
National Advisory Council on Vocational Education
Waterburg, CT

Anita Lancaster
U.S. Department of Defense
MRA&L (MP&FM) AP
Washington, DC

Julietta N. Lester
U.S. Department of Education
Office of Vocational and Adult Education
Washington, DC

Sar A. Levitan
Center for Social Policy Study
George Washington University
Washington, DC

Malcolm Lovell
U.S. Department of Labor
Washington, DC

Henry Lowenstern
Monthly Labor Review
Washington, DC

Paul Manchak
U.S. Department of Education
Office of Vocational and Adult Education
Washington, DC

Marc A. Matland
Consultant
Washington, DC

Ken McLennan
Committee for Economic Development
Washington, DC

Judith Maher
Appalachian Regional Commission
Washington, DC

Harriet Medarts
U.S. Department of Education
Office of Vocational and Adult Education
Washington, DC

Jack A. Meyer
American Enterprise Institute
Washington, DC

Michael Morton
State Advisory Council for Vocational Education
Annapolis, MD

Jay Noell
U.S. Department of Education
Washington, DC

Ann Orr
U.S. Army Research Institute
Alexandria, VA

Marion Pines
Mayor's Office of Manpower Resources
Baltimore, MD

Roni D. Posner
American Vocational Association
Arlington, VA

Paul I. Pothin
HQS U.S.A.F. ROC/LA
The Pentagon
Washington, DC

Frank C. Pratzner
The National Center for Research in Vocational Education
The Ohio State University
Columbus, OH

Dave Pritchard
U.S. Department of Education
Office of Vocational and Adult Education
Washington, DC

V. Lane Rawlins
Department of Economics
Washington State University
Pullman, WA

Markley Roberts
AFL-CIO
Washington, DC

Melvin M. Rottenberg
Appalachian Regional Commission
Washington, DC

Phyllis E. Reed
State Advisory Council for
Vocational Education
Annapolis, MD

Beatrice Reubens
Conservation of Human Resources
New York, NY

Anthony Robinson
Small Business Administration
Washington, DC

Howard Rosen
Consultant
Bethesda, MD

Neal H. Rosenthal
U.S. Department of Labor
Bureau of Labor Statistics
Washington, DC

Monica Sandoval
Intercultural Development
Research Association
San Antonio, TX

Henrietta Schwartz
School of Education
San Francisco State University
San Francisco, CA

Ellen Sehgal
U.S. Department of Labor
Employment and Training
Administration
Washington, DC

Susan W. Sherman
National Academy of Sciences
Washington, DC

Warren Simmons
National Institute of Education
Washington, DC

Rita Spivey
Appalachian Regional Commission
Human Resources Division
Washington, DC

Harold Starr
The National Center for Research
in Vocational Education
The Ohio State University
Columbus, OH

David W. Stevens
University of Missouri
Columbia, MO

Sol Swerdloff
Manpower and Education
Research Association
Arlington, VA

Robert E. Taylor
The National Center for Research
in Vocational Education
The Ohio State University
Columbus, OH

Les Thompson
U.S. Department of Education
Office of Vocational and Adult
Education
Washington, DC

Sheila Tolliver
Office of the Governor of Maryland
Annapolis, MD

Jack E. Triplett
U.S. Department of Labor
Bureau of Labor Statistics
Washington, DC

Donald Tynes
Department of Personnel
State of Maryland
Baltimore, MD

Alan Vanneman
Employment and Training Reporter
Washington, DC

Jean Vanski
National Science Foundation
Washington, DC

Denie S. Weil
The German Marshall Fund of U.S.
Washington, DC

Lana Wertz
Aetna Life and Casualty
Hartford, CT

Jan Williams
George Washington University
Washington, DC

Willard Wirtz
National Institute for Work and Learning
Washington, DC

Steve Zwillinger
U.S. Department of Education
Office of Vocational and Adult Education
Washington, DC

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